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Report of the Scientific and Technical Subcommittee on its thirty-seventh session, held in Vienna from 7 to 18 February 2000

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I. Introduction

1. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space held its thirty-seventh session at the United Nations Office at Vienna from 7 to 18 February 2000 under the chairmanship of Dietrich Rex (Germany).

2. The Subcommittee held 19 meetings.

A. Attendance

3. Representatives of the following Member States attended the session: Argentina, Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, Colombia, Cuba, Czech Republic, Ecuador, Egypt, France, Germany, Greece, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Italy, Japan, Kazakhstan, Kenya, Lebanon, Mexico, Morocco, Netherlands, Nigeria, Pakistan, Philippines, Poland, Portugal, Republic of Korea, Romania, Russian Federation, South Africa, Spain, Sudan, Sweden, Syrian Arab Republic, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay and Venezuela.

4. Representatives of the following specialized agencies and other organizations in the United Nations system attended the session: United Nations Educational, Scientific and Cultural Organization (UNESCO), International Telecommunication Union (ITU), World Meteorological Organization (WMO) and International Atomic Energy Agency (IAEA).

5. The session was also attended by representatives of the European Space Agency (ESA), the International Mobile Satellite Organization (IMSO), the Committee on Space Research (COSPAR), the International Astronautical Federation (IAF), the International Astronomical Union (IAU), the International Society for Photogrammetry and Remote Sensing (ISPRS) and the International Space University (ISU).

6. A list of the representatives of Member States, specialized agencies and other international organizations attending the session is contained in document A/AC.105/C.1/INF/29.

7. At the 525th and 526th meetings, the Chairman informed the Subcommittee that requests had been received from the permanent representatives of Bolivia, Costa Rica, Finland, Georgia, Guatemala, Malaysia, Peru, Saudi Arabia, Slovakia, Sri Lanka, Switzerland and Tunisia to attend the session. Following past practice, they were invited to send delegations to attend the current session of the Subcommittee and to address it as appropriate, without prejudice to further requests of that nature; that action did not involve any decision of the Subcommittee concerning status but was a courtesy that the Subcommittee extended to those delegations.

B. Adoption of the agenda

8. On 7 February 2000, the Subcommittee adopted the following agenda:

1. Adoption of the agenda.
2. Statement by the Chairman.
3. General exchange of views and introduction to reports submitted on national activities.
4. The United Nations Programme on Space Applications and the coordination of space activities within the United Nations system following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III).
5. Matters relating to remote sensing of the Earth by satellites, including applications for developing countries and monitoring of the Earth's environment.
6. Use of nuclear power sources in outer space.
7. International cooperation in human spaceflight.
8. Presentations on new launch systems and ventures.
9. Space debris.
10. Examination of the physical nature and technical attributes of the geostationary orbit and of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to developments in space communications, taking particular account of the needs and interests of developing countries.
11. Draft provisional agenda for the thirty-eighth session of the Scientific and Technical Subcommittee.

12. Report to the Committee on the Peaceful Uses of Outer Space.

C. Documentation

9. A list of the documents that were before the Subcommittee is provided in annex I to the present report.

D. General statements

10. Statements were made by representatives of the following delegations during the general exchange of views: Argentina, Austria, Brazil, Canada, China, Colombia, Czech Republic, Egypt, France, Germany, Greece, Hungary, India, Indonesia, Iran (Islamic Republic of), Italy, Japan, Morocco, Pakistan, Republic of Korea, Romania, Russian Federation, Saudi Arabia, Spain, Sudan, United Kingdom and United States of America. Statements were also made by the representatives of IAF, IAU, ISPRS and ISU.

11. During the general exchange of views, some delegations expressed the view that it would be desirable to expand the membership of the Committee on the Peaceful Uses of Outer Space. The Subcommittee noted that that matter should be considered by the Committee itself.

12. At the 526th meeting, the Director of the Office for Outer Space Affairs of the Secretariat made a statement reviewing the work programme of the Office. At the 527th meeting, the Expert on Space Applications made a statement outlining the activities carried out and planned under the United Nations Programme on Space Applications.

13. The Subcommittee expressed its gratitude to the Chairman, Dietrich Rex (Germany), for his guidance and exemplary work, in particular his contribution to matters relating to space debris.

14. The Chairman, on behalf of the Subcommittee, expressed his gratitude to Nandasiri Jasentuliyana, the former Director of the Office for Outer Space Affairs, for his dedication to the work of the Committee and its subcommittees in over 30 years of service in the Office for Outer Space Affairs, and to Adigun Abiodun, the former Expert on Space Applications, for his commitment to promoting expertise in space science and technology in developing countries.

15. The Subcommittee noted with appreciation that the Government of France would provide an associate expert in space law to assist the Office for Outer Space Affairs in carrying out its work.

16. The representative of Austria, on behalf of the Group of Western European and Other States, informed the Scientific and Technical Subcommittee that it intended to nominate Karl Doetsch (Canada) as Chairman of the Subcommittee for the three-year term starting at its thirty-eighth session, in 2001.

E. Technical presentations

17. In accordance with General Assembly resolution 54/67 of 6 December 1999, a symposium on the theme "Space commercialization: an era of new opportunities and challenges" was organized by COSPAR and IAF. The first part of the symposium, entitled "Overview of space commercialization", was held on 7 February 2000 and was chaired by K. Doetsch, representing IAF. The second part of the symposium, entitled "Commercialization of space exploration", was held on 8 February 2000 and was chaired by J. Andersen, representing COSPAR.

18. The presentations to the symposium included the following: "Overview of space commercialization", by L. Rains of Space News; "Towards a European global navigation system", by A. Steciw of ESA; "Commercial aspects of remote sensing", by D. El Hadani of the Royal Centre for Remote Sensing of Morocco; "Personal mobile satellite communication systems", by A. Fuller of IMSO; "The Integrated Global Observing Strategy: commercial opportunities", by R. Landis of WMO; "Commercialization of space exploration", by K. Doetsch of ISU; "Clear radio skies", by J. Cohen of the Jodrell Bank Observatory; "Commercialization of the International Space Station: SPACEHAB", by B. Harris of SPACEHAB; and "Benefits to space applications of low-cost access to space", by Wei Sun of the Surrey Space Centre.

19. In accordance with General Assembly resolution 54/68 of 6 December 1999, a symposium entitled "Interactive Multimedia Satellite Services: Implications for the Twenty-first Century" was held on 9 February 2000 to strengthen the partnership of the Subcommittee with industry. The symposium was moderated by B. Mahone of the Aerospace Industries Association.

20. The presentations to the symposium included the following: "New skies, new opportunities: satellite

communication opportunities for Member States arising from the creation of New Skies Satellites", by A. Faiola of New Skies Satellites Ltd.; "Trends in multimedia applications of space technology", by B. Mahone of the Aerospace Industries Association; "Satellite multimedia services in the Asia-Pacific region", by Ki-Jin Boo of Korea Telecom; "Space-based multimedia communications systems", by Y. Zubarev of the State Science and Research Institute of Radio of the Russian Federation; "SkyBridge: multimedia satellites", by P. Spencer of SkyBridge; and "Multimedia satellite services: African perspectives", by L. Shope-Mafole (South Africa).

21. Pursuant to General Assembly resolution 54/67, technical presentations were made by the following representatives on the issue of space debris and the solutions currently being adopted in that area at the national and international levels: F. Alby (France); V. Agapov (Russian Federation); M. Yakovlev (Russian Federation); N. Johnson (United States); W. Flury, in his capacity as representative of ESA; and W. Flury, in his capacity as representative of the Inter-Agency Space Debris Coordination Committee (IADC).

22. Pursuant to General Assembly resolution 54/67, technical presentations were made by the following representatives on the issue of remote sensing of the Earth by satellites:

(a) I. Glazokova (Russian Federation): the creation of a European environmental monitoring service;

(b) V. Oraevsky (Russian Federation): the application of small satellites for monitoring of natural and technogenic disasters;

(c) S. Pulinets (Russian Federation): remote sensing techniques for registration of short-term precursors of disastrous earthquakes from on-board space platforms and the possible Earth-space system for their global monitoring.

23. Pursuant to General Assembly resolution 54/67, technical presentations were made by the following representatives on the use of nuclear power sources in outer space:

(a) S. Harbison (United Kingdom): the United Kingdom position on technical processes and technical standards relevant to nuclear power sources in space;

(b) J. Wheeler (United States): safety processes and standards for United States space and terrestrial nuclear power systems;

(c) A. González of IAEA: the use of nuclear power sources.

24. Pursuant to General Assembly resolution 54/67, K. Clark (United States) made a technical presentation on the International Space Station.

25. Pursuant to General Assembly resolution 54/67, technical presentations were made by the following representatives on new launch systems and ventures:

(a) M. Doubovik (France): STARSEM, a Euro-Russian venture on space transportation;

(b) M. Oehm (Germany): EUROCKOT, a new German/Russian commercial launch service provider;

(c) M. Nair (India): the Geosynchronous Satellite Launch Vehicle (GSLV), the new launch vehicle of the Indian Space Research Organization (ISRO);

(d) E. Motornyi (Russian Federation): the Angara launcher family, a status report;

(e) B. Mahone (United States): new United States launch ventures.

26. Pursuant to General Assembly resolution 54/67, technical presentations were made by the following:

(a) J. Andersen of IAU: international coordination related to near-Earth objects;

(b) K. Snook and J. Moody of the Youth Advisory Council: the Youth Advisory Council.

27. The Subcommittee noted with satisfaction the quantity and quality of the technical presentations.

F. Adoption of the report of the Scientific and Technical Subcommittee

28. After considering the various items before it, the Subcommittee, at its 543rd meeting, on 18 February 2000, adopted its report to the Committee on the Peaceful Uses of Outer Space, containing its views and recommendations as set out in the paragraphs below.

II. United Nations Programme on Space Applications and the coordination of space activities within the United Nations system following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III)

29. In accordance with General Assembly resolution 54/67, the Scientific and Technical Subcommittee continued its consideration of the item on the United Nations Programme on Space Applications and the coordination of space activities within the United Nations system and reconvened the Working Group of the Whole under this item to consider the future work of the Subcommittee in the light of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III).

30. The representatives of Brazil, the Czech Republic, France, Greece, Hungary, Indonesia, Japan, Morocco, Nigeria, Romania, the United States and Venezuela made statements under this agenda item.

31. The Subcommittee had before it a conference room paper (A/AC.105/C.1/2000/CRP.4) in which Canada proposed that the Subcommittee consider establishing an informal working group on the implementation of the recommendations of UNISPACE III, using the Committee on Earth Observation Satellites (CEOS) as a model. It was proposed that the Working Group of the Whole be requested by the Subcommittee to act as the informal working group and to establish informal, open-ended task forces, each dedicated to recommendations of UNISPACE III on a particular subject. Intergovernmental and non-governmental organizations and other interested parties, including industry, could participate in the task forces. The task forces would be chaired by representatives of Member States, conduct their work by consensus, meet as often as necessary and report back to the informal working group. The task forces would be encouraged to use electronic channels of communication as much as possible and to coordinate their meetings, as required, during the sessions of the Subcommittee. While some delegations expressed their support for the proposal, others were of the view that the proposed mechanism for implementing the recommendations of UNISPACE III would not be appropriate within the framework of the Subcommittee and its Working Group of the Whole.

32. The Working Group of the Whole was chaired by Muhammad Nasim Shah (Pakistan). It held nine meetings from 10 to 17 February 2000.

33. At the 543rd meeting of the Subcommittee on 18 February 2000, the Chairman of the Working Group of the Whole made a statement and presented to the Subcommittee the report of the Working Group of the Whole. At the same meeting, the Subcommittee endorsed the report of the Working Group of the Whole, which is contained in annex II to the present report.

A. United Nations Programme on Space Applications

34. The Subcommittee had before it the report of the United Nations Expert on Space Applications (A/AC.105/730). The report was supplemented by a statement from the Expert. The Subcommittee noted that the United Nations Programme on Space Applications for 1999 had been carried out satisfactorily and commended the work accomplished by the Expert in that regard.

35. The Subcommittee noted with appreciation that, since its previous session, additional contributions for 1999 and 2000 had been offered by various Member States and organizations and had been acknowledged in the report of the Expert (A/AC.105/730, paras. 36-37). The Subcommittee also noted with appreciation that the Government of Austria had once again provided an associate expert to support the implementation of the United Nations Programme on Space Applications.

36. The Subcommittee continued to express its concern over the still limited financial resources available for carrying out the United Nations Programme on Space Applications and appealed to Member States to support the Programme through voluntary contributions. The Subcommittee felt that the limited resources of the United Nations should be focused on the activities with the highest priority and noted that the United Nations Programme on Space Applications was the priority activity of the Office for Outer Space Affairs.

37. The Subcommittee noted with satisfaction that the General Assembly, in its resolution 54/68, had requested the Secretary-General to modify the terms of reference of the Trust Fund for the United Nations Programme on Space

Applications to include implementation of the recommendations of UNISPACE III. The Subcommittee also noted with satisfaction that, in the same resolution, the Assembly had also requested the Secretary-General to invite all States to contribute voluntarily to the Trust Fund and, in his letter of invitation, to identify priority project proposals, on the basis of recommendations of the Committee on the Peaceful Uses of Outer Space, and had requested the Office for Outer Space Affairs to provide the Committee with a report listing those States which had responded to his invitation.

38. The Subcommittee noted that the United Nations Programme on Space Applications had achieved much with limited resources. The Subcommittee agreed that there was no need for radical changes; however, it noted that the Programme could be reoriented to better assist developing countries and countries with economies in transition in participating in and benefiting from the implementation of the recommendations of UNISPACE III, particularly those contained in the Vienna Declaration on Space and Human Development.[1] For this purpose, the emphasis should be on identifying a number of well-defined areas of priority, on optimizing the relation between the various types of activities conducted under the Programme, on seeking to strengthen partnerships for cooperation and initiating new ones and on increasing the financial and in-kind resources available for carrying out the mandate of the Programme.

39. The Subcommittee noted that the Programme was aimed at promoting, through international cooperation, the use of space technologies and space-related data for sustainable economic and social development in developing countries by raising the awareness of decision makers of the cost-effectiveness and additional benefits to be obtained; establishing or strengthening the capacity in developing countries to use space technology; and strengthening outreach activities to disseminate awareness of the benefits obtained. The Subcommittee also noted that, in implementing the Programme, the Expert on Space Applications would take into consideration the guidelines provided by the Working Group of the Whole, contained in annex II to the present report.

40. The Subcommittee noted that the activities of the Programme would focus on:

(a) Supporting education and training for building capacity in developing countries through:

(i) Providing support to the regional centres for space science and technology education, including the Network of Space Science and Technology Education and Research Institutions in Central Eastern and South-Eastern Europe;

(ii) Organizing workshops on advanced space applications and short- and medium-term training programmes;

(iii) Reorienting the long-term fellowship programme, including the provision of support for the implementation of pilot projects;

(iv) Promoting the participation of university graduates and young professionals in space activities;

(b) Providing technical assistance to promote the use of space technologies in development programmes by:

(i) Continuing to support pilot projects as follow-up to past activities of the Programme (e.g. the series of courses and workshops organized in cooperation with ESA);

(ii) Initiating cooperative pilot projects in areas of priority concern to Member States;

(iii) Providing technical advice, on request, to Member States, bodies and specialized agencies of the United Nations system and relevant national and international organizations;

(c) Enhancing access to space-related data and other information by:

(i) Identifying existing information systems and promoting their use and enrichment;

(ii) Implementing an outreach programme for university graduates, young professionals, decision makers and the general public;

(iii) Further developing the international space information system (through the home page of the Office for Outer Space Affairs and published materials, including multimedia publications on CD-ROM).

41. The Subcommittee noted that the Expert on Space Applications had proposed to strengthen the Programme by (A/AC.105/730, para. 35):

(a) Increasing the resources available to it by internally adjusting priorities and by seeking additional regular and extrabudgetary funds and in-kind contributions;

(b) Further orienting several activities of the Programme to support priority objectives;

(c) Working with the regional commissions and specialized agencies of the United Nations system and relevant national and international organizations;

(d) Establishing flexible but well-defined terms for cooperation with partners (for instance, what is to be achieved and in which time-frame);

(e) Fostering, incrementally, the participation of private industry in its activities;

(f) Establishing feedback mechanisms with clients and cooperating partners.

1. Year 1999

United Nations conferences, training courses and workshops

42. With regard to the activities of the United Nations Programme on Space Applications carried out in 1999, the Subcommittee expressed its appreciation to the following:

(a) The Government of Jordan, as well as ESA, for co-sponsoring the Eighth United Nations/European Space Agency Workshop on Basic Space Science, hosted by the Al al-Bayt University and held in Mafraq, Jordan, from 13 to 17 March 1999;

(b) The Government of Sweden, represented by the Swedish International Development Cooperation Agency, for co-sponsoring the Ninth United Nations/Sweden International Training Course on Remote Sensing Education for Educators, hosted by the University of Stockholm and the Swedish Space Corporation and held in Stockholm and Kiruna, Sweden, from 3 May to 11 June 1999;

(c) The Government of China, as well as ESA, for co-sponsoring the United Nations/China/European Space Agency Conference on Space Applications in Promoting Sustainable Agriculture, hosted by the Ministry of Science and Technology and the Ministry of Agriculture of China and held in Beijing from 14 to 17 September 1999;

(d) The Government of the Netherlands, as well as IAF, for co-sponsoring the United Nations/International Astronautical Federation Workshop on Space: an Integral Part of Sustainable Development, held in Enschede, the Netherlands, from 30 September to 3 October 1999;

(e) The Government of Spain for co-sponsoring the United Nations/Spain Workshop on Space Technology for Emergency Aid/Search and Rescue Satellite-Aided Tracking System for Ships in Distress, hosted by the National Institute for Aerospace Technology (INTA) of Spain and held in Maspalomas, Gran Canaria, Spain, from 23 to 26 November 1999.

Long-term fellowships for in-depth training

43. The Subcommittee expressed appreciation to ESA for having offered three fellowships for research in remote sensing technology at the European Space Research Institute facilities of ESA in Frascati, Italy.

44. The Subcommittee noted that it was important to increase the opportunities for in-depth education in all areas of space science, technology and applications projects through long-term fellowships and urged Member States to make such opportunities available at their relevant institutions.

Technical advisory services

45. The Subcommittee took note of the following technical advisory services being provided under the United Nations Programme on Space Applications in support of projects involving regional space applications:[2]

(a) Collaboration with ESA on follow-up activities relating to the series of workshops on basic space science;

(b) Providing assistance to support the growth and operation of the Asia-Pacific Satellite Communications Council (APSCC), as well as technical assistance in the preparations for the APSCC 2000 Conference and Exhibition, entitled "New Vision for Satellite Communication in the 21st Century";

(c) Co-sponsoring with the American Institute of Aeronautics and Astronautics a workshop on the theme "International space cooperation: solving global problems", held in Bermuda from 11 to 15 April 1999;

(d) Presenting the results of UNISPACE III at the second Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific, organized by the Economic and Social Commission for Asia and the Pacific (ESCAP), hosted by the Government of India and held in New Delhi from 15 to 20 November 1999;

(e) Presenting the results of UNISPACE III to the thirteenth plenary meeting of the Committee on Earth Observation Satellites (CEOS), held in Stockholm from 10 to 12 November 1999, and offering to support CEOS activities in the year 2000;

(f) Assisting ESA in providing the Water Research Institute in Accra with computers and software to strengthen the indigenous capability in using remote

sensing and Geographic Information System (GIS) data in various environmental and water resource applications in Ghana;

(g) Collaborating with ESA and the Department of Economic and Social Affairs of the Secretariat in providing the necessary technical assistance and expertise required for initiating a project on the use of Earth observation data for monitoring glaciers and snow cover in Latin America, as well as for implementing in the year 2000 projects in Africa and in Asia and the Pacific aimed at strengthening the capacity of participating institutions in developing countries to use satellite data for resource management.

Promotion of greater cooperation in space science and technology

46. The Subcommittee noted that the United Nations Programme on Space Applications had co-sponsored the participation of scientists from developing countries in the United Nations/International Astronautical Federation Workshop on Space, held in Enschede from 30 September to 3 October 1999, and the participation of those scientists in the fiftieth Congress of the International Astronautical Federation, held from 4 to 8 October 1999.

47. The Subcommittee noted that the United Nations Programme on Space Applications had collaborated with the Bulgarian Academy of Sciences on the national coordinators' meeting on the operation and functioning of the Network of Space Science and Technology Education and Research Institutions for Central Eastern and South-Eastern Europe, held in Sofia from 21 to 22 October 1999.

2. Year 2000

United Nations conferences, training courses, workshops and symposia

48. The Subcommittee recommended the approval of the following programme of workshops, training courses and symposia planned for 2000:

(a) Tenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators, to be held in Kiruna and Stockholm, Sweden, from 2 May to 9 June 2000;

(b) Ninth United Nations/European Space Agency Workshop on Basic Space Science: Satellites and Network of Telescopes—Tools for Global Participation in the Studies of the Universe, to be held in Toulouse, France, from 27 to 30 June 2000;

(c) United Nations/European Space Agency/Committee on Space Research Workshop on Data Analysis Techniques, to be held in Bangalore, India, in August 2000;

(d) United Nations/Austria symposium on promoting the participation of young professionals in space-related fields, to be held in Graz, Austria, from 11 to 14 September 2000;

(e) United Nations/International Astronautical Federation Workshop on Operational Strategy for Sustainable Development Using Space, to be held in São José dos Campos, Brazil, from 28 to 30 September 2000;

(f) United Nations/International Academy of Astronautics Workshop on Small Satellites in Latin America, to be held during the fifty-first Congress of the International Astronautical Federation in Rio de Janeiro, Brazil, in October 2000;

(g) United Nations/European Space Agency Workshop on the Use of Space Technology in Disaster Management, to be held in Iquique, Chile, during the fourth quarter of 2000;

(h) United Nations Workshop on Multimedia Satellite Applications, to be held in Kuala Lumpur during the fourth quarter of 2000;

(i) The following workshops to be organized in the year 2000 at the regional centres for space science and technology education, affiliated to the United Nations:

(i) In India:

a. Workshop on Satellite Meteorology and Global Climate;

b. Workshop on Space and Atmospheric Science;

c. Workshop on Remote Sensing and Geographic Information Systems;

(ii) In Morocco:

a. Workshop on Remote Sensing and Geographic Information Systems;

b. Workshop on Space Telecommunications;

(iii) In Nigeria: Workshop on Remote Sensing and Geographic Information Systems.

49. The Subcommittee noted that the United Nations Programme on Space Applications would co-sponsor the participation of scientists from developing countries in the

thirty-third Scientific Assembly of the Committee on Space Research, to be held in Warsaw from 16 to 23 July 2000.

50. The Subcommittee noted that, in his report (A/AC.105/730, para. 5), the Expert on Space Applications had indicated that the activities of the Programme to be implemented in 2000 would be presented to the Committee on the Peaceful Uses of Outer Space at its forty-third session for its approval.

3. Year 2001

51. The Subcommittee noted that the following activities had been proposed for 2001:

(a) Eleventh United Nations/Sweden International Training Course on Remote Sensing Education for Educators, to be held in Stockholm and Kiruna, Sweden;

(b) United Nations/European Space Agency Workshop on Remote Sensing for Environmental Monitoring and Natural Resource Management, to be held in Prague;

(c) United Nations/International Astronautical Federation workshop on the use of space technology for the benefit of developing countries, to be held in Toulouse, France;

(d) Tenth United Nations/European Space Agency Workshop on Basic Space Science, for developing countries in Africa, to be held in Mauritius;

(e) United Nations/Austria symposium on promoting the participation of young professionals in space-related fields, to be held in Graz, Austria;

(f) Several workshops to be organized at the regional centres for space science and technology education.

B. International space information service

52. The Subcommittee noted with satisfaction that the eleventh in the series of documents containing selected papers from the activities of the Programme, entitled *Seminars of the United Nations Programme on Space Applications*, had been issued.[3] A booklet entitled *Space for Development*, which contained detailed descriptions of past and ongoing activities of the United Nations Programme on Space Applications and an indication of its future activities, had been issued for UNISPACE III. The Subcommittee also noted with satisfaction the publication of *Highlights in Space 1999*[4] and of the proceedings of the Technical Forum at UNISPACE III.[5]

53. The Subcommittee noted with satisfaction that information for Member States and the general public on the latest developments in the activities carried out by the Programme including presentations made at events organized by the Office for Outer Space Affairs, had been made available on the web site of the Office for Outer Space Affairs (http://www.un.or.at/OOSA). The schedules, objectives and programmes of planned activities had also been made available on that web site.

C. Reports

54. The Subcommittee took note with appreciation of the reports submitted to it by Member States (A/AC.105/729 and Add.1 and 2) in response to a request made by the Committee on the Peaceful Uses of Outer Space at its forty-second session.[6]

D. Coordination of space activities within the United Nations system and inter-agency cooperation

55. The Subcommittee continued to stress the necessity of ensuring continuous and effective consultations and coordination in the field of outer space activities among organizations within the United Nations system and the avoidance of duplicative activities. The Subcommittee noted with satisfaction that the United Nations Programme on Space Applications had begun to enhance coordination efforts with regional space events such as the ESCAP Regional Space Applications Programme for Sustainable Development in Asia and the Pacific.

56. The Subcommittee noted with satisfaction that the Inter-Agency Meeting on Outer Space Activities had held its twentieth session at the United Nations Office at Vienna from 2 to 4 February 2000 and that the report on its deliberations (A/AC.105/727) and the report of the Secretary-General entitled "Coordination of outer space activities within the United Nations system: programme of work for 2000 and 2001 and future years" (A/AC.105/726) were before the Subcommittee.

57. The Subcommittee noted that the next session of the Inter-Agency Meeting on Outer Space Activities was scheduled to be held from 22 to 24 January 2001 at the

United Nations Office at Vienna and that it would be hosted by the Office for Outer Space Affairs.

E. Regional and interregional cooperation

58. The Subcommittee noted with appreciation the continuing efforts undertaken by the United Nations Programme on Space Applications, in accordance with General Assembly resolution 45/72 of 11 December 1990, in leading an international effort to establish regional centres for space science and technology education in existing national or regional educational institutions in developing countries. The Subcommittee also noted that, once established, each centre could expand and become part of a network that could cover specific programme elements in established institutions related to space science and technology in each region.

59. The Subcommittee recalled that the General Assembly, in its resolution 50/27 of 6 December 1995, had endorsed the recommendation of the Committee that the centres be established on the basis of affiliation to the United Nations as early as possible and that such affiliation would provide the centres with the necessary recognition and would strengthen the possibilities of attracting donors and of establishing academic relationships with national and international space-related institutions.

60. The Subcommittee noted with satisfaction that the African Regional Centre for Space Science and Technology—in French Language had held a workshop in Rabat from 22 to 23 November 1999 on the orientation of the scientific activities of the Centre and that the Centre has started preparation of a directory of available African skills in space technology. The Subcommittee also noted that two courses were scheduled to begin in 2000.

61. The Subcommittee noted with satisfaction the highlights of the programme of the African Regional Centre for Space Science and Technology Education—in English Language to be held at Ile-Ife, Nigeria, in 2000, presented in the report of the Expert on Space Applications (A/AC.105/730, para. 12).

62. The Subcommittee noted with satisfaction that the Centre for Space Science and Technology Education in Asia and the Pacific held its fourth Governing Board Meeting and its first Advisory Committee Meeting in New Delhi on 6 and 7 July 1999. The number of member States had reached 14. Three courses on remote sensing and geographic information systems (GIS), a course on satellite communication, a course on satellite meteorology and a course on space and atmospheric sciences had been held since the inauguration of the Centre. A second course on satellite communication had commenced on 1 July 1999 and a fourth course on remote sensing and GIS had begun on 1 October 1999.

63. The Subcommittee noted with satisfaction that, with the assistance of the Office for Outer Space Affairs, the member States concerned in Asia and the Pacific were undertaking consultations with a view to making the Centre for Space Science and Technology Education in Asia and the Pacific grow into a network of nodes.

64. The Subcommittee noted with satisfaction that the first meeting of the Governing Board of the Regional Centre for Space Science and Technology Education in Latin America and the Caribbean had been held in Brasilia on 15 October 1999.

65. The Subcommittee noted with satisfaction that, following the review of a report on an evaluation mission and of offers and commitments made by interested countries, Jordan had been identified as the country that would host the Regional Centre for Space Science and Technology Education in Western Asia. The Office for Outer Space Affairs had announced the establishment and location of the Centre.

66. The Subcommittee noted with satisfaction the report presented by the Chairman of the Steering Committee of the Network of Space Science and Technology Education and Research Institutions for Central Eastern and South-Eastern Europe on the activities of the Network that had been carried out since the last session of the Subcommittee.

67. The Subcommittee emphasized the importance of regional and international cooperation in making the benefits of space technology available to all countries by such cooperative activities as sharing payloads, disseminating information on spin-off benefits, ensuring compatibility of space systems and providing access to launch capabilities at reasonable cost.

III. Matters relating to remote sensing of the Earth by satellites, including applications for developing countries and monitoring of the Earth's environment

68. In accordance with General Assembly resolution 54/67, the Subcommittee continued its consideration of the item relating to remote sensing of the Earth.

69. In the course of the debate, delegations reviewed national and cooperative programmes in remote sensing. Examples were given of national programmes and of bilateral, regional and international cooperation, including programmes of technical cooperation among developing countries and programmes of countries with advanced capabilities to provide assistance to developing countries. The representatives of Argentina, Brazil, China, France, Hungary, India, Indonesia, Japan, Morocco and the United States, as well as the representative of ISPRS, made statements under this agenda item.

70. Representatives of the Russian Federation made three scientific and technical presentations on the subject of remote sensing (see para. 22 above).

71. The Subcommittee noted with satisfaction the subsection entitled "Environment and natural resources and remote sensing" in the report of UNISPACE III.[5]

72. The Subcommittee emphasized the importance of providing non-discriminatory access to state-of-the-art remote sensing data and to derived information at reasonable cost and in a timely manner and of building capacity in the adoption and use of remote sensing technology, in particular to meet the needs of developing countries.

73. The Subcommittee considered that international cooperation in the use of remote sensing satellites should be encouraged. It noted the importance of compatibility and complementarity of existing and future remote sensing systems, as well as the need for continuity in the acquisition of data. The Subcommittee also noted the importance, particularly for developing countries, of sharing experiences and technologies, of cooperating through international and regional remote sensing centres and of working on collaborative projects. The Subcommittee took note of the important contributions made by organizations such as CEOS and by mechanisms such as the Integrated Global Observing Strategy towards international cooperation in matters relating to remote sensing.

74. The Subcommittee emphasized the importance of remote sensing systems for advancing sustainable development, including monitoring of the Earth's environment.

IV. Use of nuclear power sources in outer space

75. In accordance with General Assembly resolution 54/67, the Scientific and Technical Subcommittee continued its consideration of the item on the use of nuclear power sources in outer space under the work plan that it had adopted at its thirty-fifth session (A/AC.105/697 and Corr.1, annex III, appendix). In accordance with the work plan, the Subcommittee identified terrestrial processes and technical standards that might be relevant to nuclear power sources, including factors distinguishing nuclear power sources in outer space from terrestrial nuclear applications.

76. The Subcommittee had before it the following documents:

(a) A note by the Secretariat, entitled "National research on space debris, safety of nuclear-powered satellites and problems of collisions of sources with space debris" (A/AC.105/731);

(b) A working paper submitted by the Russian Federation entitled "Collisions between nuclear power sources and space debris" (A/AC.105/C.1/L.233);

(c) A working paper submitted by the Russian Federation entitled "Identification of terrestrial processes and technical standards with a possible relevance to nuclear power sources, including factors distinguishing the use of nuclear power sources in outer space from terrestrial nuclear power applications" (A/AC.105/C.1/L.234);

(d) A working paper submitted by the United Kingdom entitled "Technical processes and technical standards relevant to nuclear power sources in space: the position of the United Kingdom of Great Britain and Northern Ireland" (A/AC.105/C.1/L.231);

(e) A working paper submitted by the United States entitled "Review of safety processes and standards for the United States space and terrestrial nuclear power systems" (A/AC.105/C.1/L.229).

77. The Subcommittee heard technical presentations under this agenda item by representatives of the United Kingdom, the United States and IAEA, as described in paragraph 23 of the present report.

78. The Subcommittee recalled that the General Assembly, in its resolution 47/68 of 14 December 1992, had adopted the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, contained in that resolution. The Subcommittee noted that the Committee on the Peaceful Uses of Outer Space, at its fortieth session, had recalled its agreement that the Principles should remain in their current form until amended and that, before amendment, proper consideration should be given to the aims and objectives of any proposed revision.[9] The Committee had agreed with the Subcommittee (A/AC.105/672, para. 80) that, while a revision of the Principles was not necessary at the current stage, it was important that States making use of nuclear power sources should conduct their activities in full accordance with the Principles.[10]

79. The Scientific and Technical Subcommittee agreed that, at the present time, revision of the Principles was not warranted. It also agreed that, until a firm scientific and technical consensus had been reached on the revision of the Principles, it would be inappropriate to pass on the topic to the Legal Subcommittee.

80. The Scientific and Technical Subcommittee noted that the Russian Federation had hosted the fifth international seminar on nuclear power sources in outer space, held from 23 to 25 March 1999, and would be hosting an international seminar on nuclear power in outer space in the twenty-first century that would be held from 19 to 21 April 2000.

81. Statements on the agenda item were made by the representatives of France, the Russian Federation and the United States, and by the representative of IAEA.

82. In accordance with General Assembly resolution 54/67, the Subcommittee, at its 536th meeting, on 14 February 2000, reconvened its Working Group on the Use of Nuclear Power Sources in Outer Space under the chairmanship of Sam Harbison (United Kingdom). The Working Group held five meetings. At the meeting held on 18 February 2000, the Working Group adopted its report.

83. At its 543rd meeting, on 18 February 2000, the Subcommittee endorsed the report of the Working Group, which is contained in annex III to the present report.

V. International cooperation in human spaceflight

84. At its 531st meeting, following a brief introductory statement by the Chairman, the Scientific and Technical Subcommittee began its consideration of a new item for discussion entitled "International cooperation in human spaceflight", in accordance with General Assembly resolution 54/67. The Subcommittee had before it a working paper by the United States that presented an overview of the International Space Station (A/AC.105/C.1/L.235).

85. In the course of the debate, delegations reviewed past, current and anticipated national and international programmes of cooperation in human spaceflight. Examples were given of international activities involving cooperation in national human spaceflight programmes such as Apollo, Soyuz, Salyut, Skylab, Space Shuttle, Spacelab and the Mir Space Station. In addition, the nature and role of the International Space Station, as well as the activities and contributions of various States leading to its development, assembly and utilization were discussed.

86. The Subcommittee heard a technical presentation on the International Space Station by a representative of the United States (see para. 24 above).

87. The Subcommittee noted the opportunities for countries without their own autonomous human spaceflight programmes that would be made available through activities to be carried out within the framework of the International Space Station and under the past and current national human spaceflight programmes of other countries.

88. The representatives of Brazil, France, Italy, the Russian Federation and the United States made statements under this agenda item.

VI. Presentations on new launch systems and ventures

89. At its 532nd meeting, following a brief introductory statement by the Chairman, the Scientific and Technical Subcommittee began its consideration of a new item for discussion entitled "Presentations on new launch systems and ventures", in accordance with General Assembly resolution 54/67.

90. In the course of the debate, delegations reviewed advances by Governments and non-governmental organizations in developing a wide variety of new launch systems,

including modular launch vehicles, reusable launch vehicles and launch vehicles based on intercontinental ballistic missiles. The representatives of Germany, the Russian Federation and the United States made statements under this agenda item.

91. The Subcommittee noted developments within the private sector, including international joint ventures, as well as action by Governments to supervise activities of the private sector in this field.

92. The Subcommittee noted with satisfaction that the Legal Subcommittee, at its thirty-ninth session, in 2000, would be starting a three-year work plan entitled "Review of the concept of the 'launching State'".

93. The Subcommittee heard scientific and technical presentations on the subject of new launch systems and ventures by representatives of France, Germany, India, the Russian Federation and the United States (see para. 25 above).

VII. Space debris

94. In accordance with General Assembly resolution 54/67, the Subcommittee continued its consideration, on a priority basis, of the agenda item on space debris.

95. The Subcommittee agreed that further consideration of space debris was important and that international cooperation was needed to expand appropriate and affordable strategies to minimize the potential impact of space debris on future space missions.

96. The Subcommittee agreed that Member States should pay more attention to the problem of collisions of space objects, including those with nuclear power sources on board, with space debris and to other aspects of space debris. It noted that the General Assembly, in its resolution 53/45 of 3 December 1998, had called for the continuation of national research on that question, for the development of improved technology for the monitoring of space debris and for the compilation and dissemination of data on space debris. The Subcommittee took note of the replies from Member States (A/AC.105/731) submitted to it in accordance with that request. The Subcommittee agreed that national research on space debris should continue and that Member States and international organizations should make available to all interested parties the results of that research, including information on practices adopted that had proved effective in minimizing the creation of space debris.

97. The Subcommittee agreed that adoption of the technical report on space debris (A/AC.105/720) at its previous session was an important achievement. It recalled its recommendation, endorsed by the Committee at its forty-second session,[11] that that report should be distributed widely, including by making it available to UNISPACE III, the Legal Subcommittee at its thirty-ninth session, in 2000, international organizations such as COSPAR, the International Academy of Astronautics (IAA), IAF and IADC and scientific gatherings such as the annual IAF Congress (see A/AC.105/719, para. 35). The Subcommittee noted with satisfaction that the report had already been distributed extensively and that the Secretariat would continue to distribute it.

98. Representatives of Brazil, China, the Czech Republic, France, Germany, Greece, India, Iran (Islamic Republic of), Italy, Japan, Morocco, the Russian Federation, Spain, the United Kingdom and the United States made statements on the item.

99. The Subcommittee heard scientific and technical presentations on the subject of space debris by representatives of France, the Russian Federation, the United States of America and ESA, as mentioned in paragraph 21 of the present report.

100. The Subcommittee noted with satisfaction that, following its invitation, a representative of IADC had made a technical presentation on its work with regard to the space debris issue, as mentioned in paragraph 21 of the present report. The Subcommittee agreed that IADC should be invited to make a technical presentation on its work on an annual basis.

101. The Subcommittee noted that cooperation had continued through IADC, with the participation of Japan, the National Aeronautics and Space Administration (NASA) of the United States, ESA, the Russian Aviation and Space Agency, the China National Space Administration, the British National Space Centre, the Centre national d'études spatiales (CNES) of France, ISRO, the Italian Space Agency and the German Aerospace Centre (DLR), to enable its members to exchange information on space debris activities, facilitate opportunities for cooperation in space debris research, review the progress of ongoing activities and identify debris mitigation options. It also noted that Ukraine had recently applied for membership in IADC.

102. The Subcommittee recalled that, at its forty-second session, the Committee on the Peaceful Uses of Outer Space had agreed[12] that the Subcommittee, at its thirty-seventh session, should review international application of ITU standards and IADC recommendations concerning the disposal of satellites in geosynchronous orbit at the end of their useful life. It also recommended that, to facilitate the review by the Subcommittee, the Secretariat should compile relevant data on space objects in geosynchronous orbit.

103. The Subcommittee noted with satisfaction the report prepared by the Secretariat in response to that request (A/AC.105/734). The report contained an analysis of information received from the Canadian Space Agency, CNES, ESA, the European Organization for the Exploitation of Meteorological Satellites and the International Telecommunications Satellite Organization. The Subcommittee expressed its appreciation for the invaluable assistance in the preparation of the report provided by the Astronomical Institute of the Czech Academy of Sciences, the European Space Operations Centre in Darmstadt, Germany, and the NASA Johnson Space Center in Houston, United States.

104. The Subcommittee noted that the ITU standards and IADC recommendations with respect to the disposal of spacecraft in geostationary orbit had been developed quite recently and were not mandatory. Most satellite operators were aware of the seriousness of the space debris situation near the geostationary orbit and had acknowledged the wisdom of undertaking some mitigation measures. However, the Subcommittee noted that, because of technical and managerial problems, even self-imposed guidelines were not being followed in some cases. It also noted that more research would be needed to understand fully the space debris environment near the geostationary orbit.

105. Some delegations expressed the view that existing catalogues of space objects, including objects near to the geostationary orbit, were far from complete and that some important information was missing even for the catalogued objects. The view was expressed that a reliable catalogue of space objects, accessible to all Member States, should be developed.

106. The view was expressed that all existing space debris observation data should be made available to Member States, so that experts from countries with no means for observation of space debris could make use of those data for study and for their active participation in discussions on space debris mitigation measures.

107. The view was expressed that an index to the United Nations Register of Objects Launched into Outer Space, which would provide an easy and quick reference to governmental announcements of space launches and changes in the status of space objects, including their decay in the atmosphere, would facilitate the work of the Subcommittee. It was proposed that the Secretariat prepare a sample of such an index for the thirty-eighth session of the Subcommittee.

108. The Subcommittee took note of the working papers and conference room papers regarding the future work of the Subcommittee on the issue of space debris submitted by the Russian Federation (A/AC.105/C.1/L.232), the United States (A/AC.105/C.1/L.236), Germany (A/AC.105/C.1/L.238), France, on behalf of Austria, Canada, the Czech Republic, Germany, Greece, Hungary, India, Indonesia, Italy, Pakistan, Poland, Portugal, Romania, Spain, Sweden and the United Kingdom (A/AC.105/C.1/L.239), and Japan (A/AC.105/C.1/2000/CRP.11).

109. Some delegations expressed the view that the Committee on the Peaceful Uses of Outer Space should ask the Legal Subcommittee to give its views on the technical report on space debris and on the applicability of the current space treaties to the issue of space debris. The Legal Subcommittee could help the Scientific and Technical Subcommittee to implement a new work plan, with the objective of adopting, in the future and in the light of a revised technical report, a set of principles dedicated to reducing production of space debris and to guiding further discussion by the Scientific and Technical Subcommittee. Other delegations expressed the view that it would be premature for the Legal Subcommittee to discuss legal issues relevant to space debris.

110. The view was expressed that a multi-year work plan should be adopted by the Scientific and Technical Subcommittee in order to develop a set of international guidelines for space debris mitigation efforts. It was proposed that an open-ended expert group could be established for the implementation of such a plan and that the support of IADC to the expert group would be welcomed.

111. Other delegations were of the view that it was premature to adopt such a multi-year work plan.

112. Having considered a conference room paper submitted by Canada, France, Germany, Greece, Italy, Japan, the Russian Federation and the United States (A/AC.105/C.1/2000/CRP.18), the Subcommittee agreed

to continue its work on space debris in 2001 as reflected in the report of the Working Group of the Whole, contained in annex II to the present report.

113. The view was expressed that, in order to ensure the safety of the International Space Station and other valuable space objects, a sophisticated international system should be developed for dissemination of information on dangerous close encounters of space objects and non-controlled re-entries of space objects into the upper atmosphere. The view was also expressed that the most urgent task at present was the refinement of models of non-observable fine particulate debris, so that they could be used for more precise formulation of requirements for the protection of spacecraft, with or without crew on board, against impacts of space debris.

VIII. Examination of the physical nature and technical attributes of the geostationary orbit and of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to developments in space communications, taking particular account of the needs and interests of developing countries

114. In accordance with General Assembly resolution 54/67, the Subcommittee continued its consideration of the item relating to the geostationary orbit and space communications.

115. The representatives of Brazil, Colombia, the Czech Republic, Ecuador, Germany, Greece, Guatemala (on behalf of the Group of Latin American and Caribbean States), Indonesia and Mexico made statements under this agenda item.

116. The Subcommittee recalled that the Committee on the Peaceful Uses of Outer Space, at its forty-first session,[11] in 1998, had agreed that the following principles were universally accepted by the scientific and technical community and should be applied to future deliberations on the geostationary orbit:

(a) The existence of orbits of all satellites, including geostationary satellites, depended mainly on gravitational phenomena generated by the entire body of the Earth;

(b) A geostationary satellite, whether acted upon by natural forces only or by man-made impulses, was not fixed over a point on the Earth's equator: between corrective impulses of its station-keeping, it was in a natural flight caused by gravitational as well as non-gravitational forces generated by the Earth, the Sun and the Moon.

117. The Subcommittee took note of the working paper submitted by the Czech Republic (A/AC.105/C.1/L.230), in which it was stated that an important implication could be drawn from the statements in subparagraphs 115 (a) and (b) above. The term "outer space" had been used in several instruments of international law to denote a certain region around the Earth into which space objects were launched and where those objects moved in orbits around the centre of the Earth. Since geostationary satellites were a specific group of the Earth's satellites, their orbits were in outer space. Consequently, a third statement could be made: the geostationary orbit was an integral part of outer space.

118. Some delegations expressed the view that the three statements in paragraphs 115 and 116 above could form the scientific basis for the geostationary orbit. They expressed the view that consensus on that issue would result in more time for discussion in the Scientific and Technical Subcommittee of telecommunication services provided from satellites in the geostationary orbit. Other delegations expressed their appreciation for the working paper submitted by the Czech Republic (A/AC.105/C.1/L.230) and stated that, because of its implications, it deserved careful study by their authorities before they could react to it. They also expressed the view that the Subcommittee should continue to consider the question of the geostationary satellite orbit until all delegations were convinced that a consensus had been reached.

119. Some delegations reiterated the view that the geostationary orbit was a limited natural resource with a number of *sui generis* characteristics, which risked saturation, and that, therefore, assurances should be given that the benefits of its exploitation would be extended to all nations, regardless of their present technical capabilities. They expressed the view that access to the geostationary orbit should be granted to all nations on an equitable and rational basis, with the Committee on the Peaceful Uses of Outer Space and ITU working together towards that goal,

taking into particular account the needs and interests of developing countries.

120. The view was expressed that the special characteristics of the geostationary orbit included characteristics relating to space mechanics, launching and positioning of geostationary satellites, perturbations in the geostationary orbit, station keeping of satellites in geostationary orbit, ground stations, the nominal position of geostationary satellites above a fixed point on the Earth's equator, and retirement from service of geostationary satellites.

121. Some delegations also expressed the view that, in order to give the most thorough consideration to the important issue of the geostationary orbit, its legal aspects should continue to be discussed simultaneously by the Legal Subcommittee.

IX. Draft provisional agenda for the thirty-eighth session of the Scientific and Technical Subcommittee

122. The Scientific and Technical Subcommittee noted that the General Assembly, in its resolution 54/67, had welcomed the new approach taken by the Committee in composing the agenda of the Scientific and Technical Subcommittee[14] and had noted that the Subcommittee at its thirty-seventh session would submit its proposal to the Committee on the Peaceful Uses of Outer Space for a draft provisional agenda for the thirty-eighth session of the Subcommittee, in 2001. Pursuant to paragraph 18 of Assembly resolution 54/67, the Subcommittee requested the Working Group of the Whole, established at its 531st meeting, to consider a draft provisional agenda for its thirty-eighth session.

123. At its 543rd meeting, the Subcommittee endorsed the recommendations of the Working Group of the Whole concerning the draft provisional agenda for the thirty-eighth session of the Subcommittee as contained in the report of the Working Group of the Whole (see annex II to the present report).

124. The Subcommittee recommended that its thirty-eighth session be held from 12 to 23 February 2001.

X. Other reports

125. The Subcommittee expressed its appreciation to COSPAR for its report on space research and to IAF for its report on space technology and applications, the two reports being compiled by the Office for Outer Space Affairs and issued jointly under the title *Highlights in Space 1999*.[15]

126. The Subcommittee took note of the compilation of papers from the Technical Forum at UNISPACE III, issued under the title *Proceedings of the Technical Forum*[16] and the compilation of selected papers presented during activities of the United Nations Programme on Space Applications in 1999, issued under the title *Seminars of the United Nations Programme on Space Applications*.[17]

127. The Subcommittee noted with appreciation the participation in its current session of representatives of United Nations bodies and specialized agencies and permanent observers. The Subcommittee noted that their statements and reports had been useful in enabling it to fulfil its role as focal point for international cooperation in space.

128. The Subcommittee had before it a conference room paper (A/AC.105/C.1/2000/CRP.8) containing the proposal submitted by the Office for Outer Space Affairs for programme 4 (Peaceful uses of outer space) of the proposed medium-term plan for the period 2002-2005.

Notes

[1] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1.

[2] See the report of the Expert on Space Applications (A/AC.105/730, paras. 19-26).

[3] United Nations publication, Sales No. E.00.I.6.

[4] United Nations publication, Sales No. E.00.I.8.

[5] *Proceedings of the Technical Forum* (United Nations publication, Sales No. E.00.I.7).

[6] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* (A/54/20), para. 119.

[7] See the report of the Expert on Space Applications (A/AC.105/730, para. 11).

[8] *Report of the Third United Nations Conference on the Peaceful Uses of Outer Space* ..., paras. 87-161.

[9] *Official Records of the General Assembly, Fifty-second Session, Supplement No. 20* (A/52/20), para. 78.

[10] Ibid., para. 79.

[11] Ibid., *Fifty-fourth Session, Supplement No. 20* (A/54/20), para. 42.

[12] Ibid., para. 44.

[13] Ibid., *Fifty-third Session, Supplement No. 20* (A/53/20), para. 107.

[14] Ibid., *Fifty-fourth Session, Supplement No. 20* (A/54/20), annex I, sect. A.

[15] United Nations publication, Sales No. E.00.I.8.

[16] United Nations publication, Sales No. E.00.I.7.

[17] United Nations publication, Sales No. E.00.I.6.

Annex I

Documents before the Scientific and Technical Subcommittee at its thirty-seventh session

Symbol	*Agenda item*	*Title or description*
A/AC.105/720	9	Technical report on space debris
A/AC.105/723	4	Report on the Eighth United Nations/European Space Agency Workshop on Basic Space Science: Scientific Exploration from Space, hosted by the Institute of Astronomy and Space Sciences at Al al-Bayt University on behalf of the Government of Jordan (Mafraq, Jordan, 13-17 March 1999)
A/AC.105/725	4	Report on the Ninth United Nations/Sweden International Training Course on Remote Sensing Education for Educators (Stockholm and Kiruna, Sweden, 3 May-11 June 1999)
A/AC.105/726	4	Report of the Secretary-General on the coordination of outer space activities within the United Nations system: programme of work for 2000 and 2001 and future years
A/AC.105/727	4	Report of the Inter-Agency Meeting on Outer Space Activities (Vienna, 2-4 February 2000)
A/AC.105/728	4	Report on the United Nations/China/European Space Agency Conference on Space Applications in Promoting Sustainable Agriculture (Beijing, 14-17 September 1999)
A/AC.105/729 and Add.1 and 2	3	Note by the Secretariat on international cooperation in the peaceful uses of outer space: activities of Member States
A/AC.105/730	4	Report of the United Nations Expert on Space Applications
A/AC.105/731	6	Note by the Secretariat on national research on space debris, safety of nuclear-powered satellites and problems of collisions of sources with space debris
A/AC.105/732	4	Report on the United Nations/Spain Workshop on Space Technology for Emergency Aid/Search and Rescue Satellite-Aided Tracking System for Ships in Distress (Maspalomas, Gran Canaria, Spain, 23-26 November 1999)

Symbol	*Agenda item*	*Title or description*
A/AC.105/733	4	Report on the United Nations/International Astronautical Federation Workshop on Space: an Integral Part of Sustainable Development (Enschede, the Netherlands, 30 September-3 October 1999)
A/AC.105/734	9	Report of the Secretariat on the disposal of satellites in geosynchronous orbit
A/AC.105/C.1/L.228	1	Provisional agenda and annotations
A/AC.105/C.1/L.229	6	Working paper submitted by the United States of America on review of safety processes and standards for the United States space and terrestrial nuclear power systems
A/AC.105/C.1/L.230	10	Working paper submitted by the Czech Republic on the geostationary orbit
A/AC.105/C.1/L.231	6	Working paper submitted by the United Kingdom of Great Britain and Northern Ireland on technical processes and technical standards relevant to nuclear power sources in space: the position of the United Kingdom of Great Britain and Northern Ireland
A/AC.105/C.1/L.232	9	Working paper submitted by the Russian Federation on research by the Russian Space Agency on the question of space debris
A/AC.105/C.1/L.233	6	Working paper submitted by the Russian Federation on collisions between nuclear power sources and space debris
A/AC.105/C.1/L.234	6	Working document submitted by the Russian Federation on the identification of terrestrial processes and technical standards with a possible relevance to nuclear power sources, including factors distinguishing the use of nuclear power sources in outer space from terrestrial nuclear power applications
A/AC.105/C.1/L.235	7	Working paper submitted by the United States of America on the International Space Station: overview

Symbol	*Agenda item*	*Title or description*
A/AC.105/C.1/L.236	9	Working paper submitted by the United States of America on a proposal for consideration of matters related to space debris by the Scientific and Technical Subcommittee
A/AC.105/C.1/L.237 and Add.1-8	12	Draft report of the Scientific and Technical Subcommittee on its thirty-seventh session
A/AC.105/C.1/L.238	9	Working paper submitted by Germany on the continuation of work on space debris in 2001
A/AC.105/C.1/L.239	9	Working paper presented by France on space debris
A/AC.105/C.1/WG.5/L.35	6	Draft report of the Working Group on the Use of Nuclear Power Sources in Outer Space
A/AC.105/C.1/WG.6/L.15	4 and 11	Draft report of the Working Group of the Whole
Background documents		
A/CONF.184/6		Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999
ST/SPACE/1		Proceedings of the Technical Forum
ST/SPACE/3		Seminars of the United Nations Programme on Space Applications
ST/SPACE/4		Highlights in Space, 1999

Annex II

Report of the Working Group of the Whole

1. In accordance with paragraph 18 of General Assembly resolution 54/67 of 6 December 1999, the Working Group of the Whole was reconvened at the thirty-seventh session of the Scientific and Technical Subcommittee to consider the future work of the Subcommittee in the light of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna from 19 to 30 July 1999. The Working Group held nine meetings, from 10 to 17 February 2000, to consider the implementation of the recommendations of UNISPACE III and the draft provisional agenda for the thirty-eighth session of the Subcommittee, in 2001. At its 9th meeting, on 17 February 2000, the Working Group adopted the present report.

2. Muhammad Nasim Shah (Pakistan) was elected Chairman of the Working Group of the Whole at the 531st meeting of the Scientific and Technical Subcommittee. The Chairman, in his opening remarks, reviewed the mandate of the Working Group of the Whole at its session in 2000.

A. Implementation of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III)

3. The Working Group of the Whole expressed its satisfaction with the successful results achieved by UNISPACE III, in particular the strategy contained in the resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development" and specific action programmes recommended by the Conference. The Working Group noted that the General Assembly, in its resolution 54/68 of 6 December 1999, had endorsed the resolution and had urged Governments, organs, organizations and programmes of the United Nations system as well as intergovernmental and non-governmental organizations and industries conducting space-related activities to take the necessary action for the effective implementation of the Vienna Declaration. The Working Group of the Whole also noted that the Assembly, in the same resolution, had called upon all concerned to implement the recommendations made by UNISPACE III as reflected in its report.[a]

4. The Working Group of the Whole had before it a proposal by Canada regarding the creation of an informal working group on the implementation of the recommendations of UNISPACE III (A/AC.105/C.1/2000/CRP.4) and a list of issues to be considered in the Working Group of the Whole (A/AC.105/C.1/2000/CRP.6), prepared by the Secretariat.

5. The Working Group of the Whole made the recommendations below concerning the implementation of the recommendations of UNISPACE III.

1. Mechanism to implement the strategy to address global challenges referred to in the Vienna Declaration on Space and Human Development

6. The Working Group of the Whole noted with satisfaction that there was a high level of interest in implementing the recommendations of UNISPACE III among all member States of the Committee on the Peaceful Uses of Outer Space and other States, as well as among space agencies, relevant intergovernmental organizations, including the United Nations specialized agencies, non-governmental organizations and other space-related institutions. The Working Group of the Whole recognized the need for a mechanism to coordinate international action aimed at implementing those recommendations.

7. In reviewing the recommendations of UNISPACE III, in particular the strategy to address global challenges as contained in the Vienna Declaration on Space and Human Development, the Working Group of the Whole recognized that there were two broad categories of action that would need to be taken. Those two categories, which were not mutually exclusive, were: (a) action to be taken by Member States and/or by the Office for Outer Space Affairs of the Secretariat within the framework of the Committee on the Peaceful Uses of Outer Space and its two subcommittees; and (b) action to be taken independently or jointly by interested space agencies, intergovernmental organizations, in particular the United Nations specialized agencies, non-governmental organizations, space-related institutions and industry, as well as research institutions.

8. The Working Group of the Whole agreed that the current structure of the agenda of the Scientific and Technical Subcommittee would facilitate the consideration of those issues of global concern and the implementation of the corresponding elements of the strategy referred to in the Vienna Declaration that were relevant to the work of the Subcommittee. The Working Group of the Whole recommended that the Subcommittee consider the items contained in the nucleus of the strategy to address global challenges as reflected in the Vienna Declaration through multi-year work plans, possibly considering two of those items at each of its sessions, with the intention of ensuring that the action associated with each of the items be taken and of coordinating international efforts in that area.

9. The Working Group of the Whole recommended that the Subcommittee, at its thirty-eighth session, should consider the items entitled "Using space applications for human security, development and welfare" and "Strengthening and repositioning of space activities in the United Nations system" under the multi-year work plans.

2. Organization, during the session of the Scientific and Technical Subcommittee, of a symposium to strengthen the partnership of the Subcommittee with industry

10. The Working Group of the Whole noted that, in accordance with General Assembly resolution 54/68, the Secretariat had organized, during the thirty-seventh session of the Scientific and Technical Subcommittee, a symposium on the theme "Interactive multimedia satellite services: implications for the twenty-first century", in order to strengthen the partnership of the Subcommittee with industry. The Working Group of the Whole also noted that the symposium had been organized on a trial basis and that the Director of the Office for Outer Space Affairs had invited Member States to provide suggestions regarding the symposium, in particular its theme, its speakers and its structure.

11. The Working Group of the Whole agreed that in selecting a theme for the symposium, it should be borne in mind that the symposium should address the needs of developing countries, generate interest among the space-related industries to participate and contribute to the symposium and allow for the participation of universities and research institutions, in particular in developing countries, which could be providers of space-related services and products. The Working Group of the Whole also agreed that the theme of the symposium should be related to public services and should be broad enough to allow participation of industries on an equitable geographical basis.

12. The Working Group of the Whole agreed that the symposium to be held during the thirty-eighth session of the Scientific and Technical Subcommittee, in 2001, should focus on the emerging applications of global navigation satellite systems in improving the productivity of national and regional infrastructure such as transportation, oil and gas networks, agriculture and telecommunications. The Working Group of the Whole also agreed that the symposium to be held during the thirty-ninth session of the Subcommittee, in 2002, should focus on the promising area of very high resolution remote sensing and its impact on operational applications and should discuss the new space market situation. As for subsequent symposia, the Working Group of the Whole agreed that the task of selecting a theme should be rotated among the members of the Group of Eastern European States, the Group of 77 and China and the Group of Western European and Other States.

13. The Working Group of the Whole agreed that the Secretariat should select speakers for the symposia keeping in mind equitable geographical representation and should inform the respective Governments of the representatives of industry whom it proposed to invite. Comments by those Governments, if any, should be sent to the Secretariat within two weeks following the receipt of that information. The Working Group of the Whole recommended that the Governments concerned should be encouraged to send the speakers for the symposium.

14. The Working Group of the Whole agreed that the structure of the symposium could remain the same as that of the symposium held during the thirty-seventh session of the Subcommittee, in 2000. The Working Group of the Whole recommended that the symposium to be held during the thirty-eighth session of the Subcommittee should be scheduled on the Monday of the second week of that session. The Working Group of the Whole noted that displays and demonstrations of services and products could be arranged by interested companies or other providers of services and products following the symposium, as contributions to it. The Working Group of the Whole also noted that such contributions could include financial support for the organization of the symposium. Speakers should be encouraged to include in their presentations reference to possible financing models and arrangements related to the applications being presented each year at the symposium.

3. Promotion of the participation of youth in space activities and the establishment of a consultative mechanism within the framework of the Committee on the Peaceful Uses of Outer Space to facilitate the continued participation of young people in cooperative space-related activities

15. The Working Group of the Whole noted that the Vienna Declaration had called for action to be taken to create, within the framework of the Committee on the Peaceful Uses of Outer Space, a consultative mechanism to facilitate the continued participation of young people from all over the world, especially young people from developing countries and young women, in cooperative space-related activities.

16. The Working Group of the Whole agreed that Member States and their relevant national institutions should be invited to report to the Subcommittee on the activities that they had carried out for young people.

17. The Working Group of the Whole agreed that the regional centres for space science and technology education, affiliated to the United Nations, including the Network of Space Science and Technology Education and Research Institutions for Central Eastern and South-Eastern Europe, should be invited to include activities for young people and should be requested to report on their accomplishments in that regard.

18. The Working Group of the Whole noted that the Youth Advisory Council, a voluntary body, had been established following a recommendation of the Space Generation Forum held during UNISPACE III and had been modelled after a similar council established within the framework of the United Nations Environment Programme and that the Subcommittee had heard a presentation by two representatives of the Council.

19. The Working Group of the Whole agreed that the Youth Advisory Council could be granted observer status with the Committee on the Peaceful Uses of Outer Space, in order to facilitate the participation of young people in cooperative space-related activities. The Working Group of the Whole noted with satisfaction that the Council would seek funding to provide student interns to assist the Office for Outer Space Affairs in carrying out activities for young people within the United Nations Programme on Space Applications.

20. The Working Group of the Whole recommended that the Youth Advisory Council be invited to make a presentation on its activities at the thirty-eighth session of the Subcommittee, in 2001.

4. Celebration of World Space Week from 4 to 10 October

21. The Working Group of the Whole noted that the General Assembly in its resolution 54/68 had declared "World Space Week" from 4 to 10 October to celebrate each year at the international level the contributions of space science and technology to the betterment of the human condition.

22. The Working Group of the Whole noted with satisfaction that some Member States had already planned activities to contribute to the celebration of World Space Week. The Working Group of the Whole also noted with satisfaction that the Spaceweek International Association, an independent non-profit organization established in 1981 to coordinate public events celebrating a space week in March, had decided to change the date of its space week and had offered to assist the Office for Outer Space Affairs in coordinating events at the international level to celebrate World Space Week.

23. The Working Group of the Whole recommended that the Office for Outer Space Affairs should develop, in consultation with interested Member States and with the assistance of the Spaceweek International Association, a plan to celebrate World Space Week, for consideration by the Committee on the Peaceful Uses of Outer Space at its forty-third session, in 2000. The Working Group of the Whole also recommended that the Office for Outer Space Affairs should bring the decision of the General Assembly to the attention of space-related intergovernmental and non-governmental organizations, in particular the International Astronautical Federation, which would be organizing its Congress during World Space Week.

5. Trust Fund for the United Nations Programme on Space Applications and new and innovative funding sources to implement the recommendations of UNISPACE III

24. The Working Group of the Whole noted that the Vienna Declaration had called for a special voluntary fund for the purpose of implementing the recommendations of UNISPACE III, in particular the activities of the regional centres for space science and technology education.

25. The Working Group of the Whole noted that the General Assembly, in its resolution 54/68, had agreed that

the Committee on the Peaceful Uses of Outer Space and its secretariat should identify new and innovative funding sources for implementing the recommendations of UNISPACE III in order to supplement the resources to be provided through the Trust Fund for the United Nations Programme on Space Applications. In addition to the resources provided through the Trust Fund, support could be provided to the regional centres for space science and technology education and to the Network of Space Science and Technology Education and Research Institutions for Central Eastern and South-Eastern Europe by existing government and international financial institutions with development aid programmes, industry, space agencies, universities and specialized space-related institutions, including the United Nations specialized agencies.

26. The Working Group of the Whole noted that the Secretariat had provided suggestions on possible sources of funding for the regional centres and the Network (A/AC.105/C.1/2000/CRP.12). Industry could provide support by:

(a) Donating computer equipment, basic software licences, image-processing and Geographic Information System software and receivers of satellite positioning signals for various applications for education and for the implementation of pilot projects, and other equipment and material used for education and training in remote sensing, satellite meteorology, satellite communications and space sciences;

(b) Entering into mutually beneficial partnerships (e.g. financially supporting the institutions, thus enabling them to prepare qualified users of specific space technologies);

(c) Providing speakers at workshops organized by the regional centres and the Network.

27. Governments and international development financial institutions could provide support for the regional centres and the Network through programmes providing development aid to developing countries. The aid could be provided in several forms (e.g. financial aid, experts, education and equipment). Priorities for awarding aid could be established on the basis of diverse criteria (e.g. to developing countries from particular regions or subregions, to protect the environment and to promote health-related education). Where such development programmes existed and within existing budgetary resources and on the basis of the criteria referred to above, some funds could be earmarked for the regional centres and the Network. Governments of States members of the regional centres or the Network could discuss, within the framework of the governing bodies, the respective centres and institutions, ways and means of supporting the regional centres and the Network.

28. Space agencies, universities and specialized space-related institutions could provide support for the regional centres and the Network by: (a) providing experts, for periods of between one week and a few months, who could teach specialized parts of the education programmes at the regional centres or the institutions of the Network; (b) defraying the cost of limited amounts of data for education, training and the implementation of pilot projects; (c) organizing at the regional centres and the institutions of the Network, in coordination with the centres and the institutions concerned, workshops on the subjects in the long-term education programmes; (d) providing educational material (e.g. training kits, brochures and CD-ROMs) already produced by them; and (e) sponsoring individual pilot projects that would be part of the education programme of the regional centres and the Network.

29. A second broad category of support that would facilitate the participation of developing countries in the implementation of the recommendations of UNISPACE III would be the development of institutional capacity to use space technologies in operational programmes. The United Nations Programme on Space Applications would organize workshops, meetings of experts and training courses leading to pilot projects for incorporating and testing space technology in simulated or real operational programmes. Support could be provided through the following: (a) technical assistance in identifying user requirements and all the necessary steps that would need to be taken to introduce those technologies operationally; (b) limited amounts of optical and radar data for pilot projects with an Earth observation component (e.g. environmental assessment and monitoring, management of natural resources and disaster management); (c) free access for small amounts of transmission time through communications satellites for pilot projects with a communications component (e.g. telemedicine, tele-education and disaster management); and (d) establishment of programmes for the exchange of "visiting" personnel between institutions using space technologies on an operational basis and institutions implementing their use.

30. The Working Group of the Whole recommended that the Office for Outer Space Affairs should make the information contained in conference room paper

A/AC.105/C.1/2000/CRP.12 available to Member States and intergovernmental and non-governmental organizations, as well as industry, through such means as its web site (http://www.un.or.at/OOSA).

6. Identification and promotion of the use of appropriate space technologies to meet the needs of programmes and organizations of the United Nations system

31. The Working Group of the Whole noted that the General Assembly, in its resolution 54/68, had requested all relevant organizations of the United Nations system to take appropriate measures to ensure the full and effective implementation of the recommendations of UNISPACE III, taking into account the needs of developing countries, in particular by further enhancing the coordination of their space-related activities through the Inter-Agency Meeting on Outer Space Activities.

32. The Working Group of the Whole noted that the Inter-Agency Meeting on Outer Space Activities at its twentieth session, held in Vienna from 2 to 4 February 2000, had recommended that the Committee on the Peaceful Uses of Outer Space should establish a working group to consider, in particular, the coordination of outer space activities within the United Nations system, taking fully into account the annual report of the Secretary-General on the subject. The Working Group of the Whole also noted that the Inter-Agency Meeting had agreed that its work should be brought more prominently to the attention of the heads of organizations of the United Nations system and that the Office for Outer Space Affairs should explore the possibility of requesting the Administrative Committee on Coordination to resume its consideration of the agenda item on the coordination of the space-related activities of the United Nations system. The Working Group of the Whole welcomed the agreement of the Inter-Agency Meeting to consider at its twenty-first session, in 2001, an item entitled "Methods to strengthen further the inter-agency coordination and cooperation in space-related activities" (A/AC.105/727, paras. 30, 31 and 34).

33. The Working Group of the Whole had before it a proposal submitted by Canada, on behalf of Australia, Austria, India, the Russian Federation and the United States of America (A/AC.105/C.1/2000/CRP.3/Rev.1). According to the proposal, the Scientific and Technical Subcommittee would undertake a multi-year work plan to examine means of and mechanisms for strengthening inter-agency cooperation and increasing the use of space applications and services among the organizations of the United Nations system. The Working Group of the Whole agreed that an item reflecting the proposal by Canada should be included in the draft provisional agenda for the thirty-eighth session of the Subcommittee.

7. Strengthening of the activities of the United Nations Programme on Space Applications

34. The Working Group of the Whole noted that the General Assembly, in its resolution 54/68, had requested the Secretary-General to recommend measures to ensure that the Office for Outer Space Affairs was provided with adequate resources to implement certain actions, including strengthening of the activities of the United Nations Programme on Space Applications.

35. With regard to the support to be provided by the United Nations Programme on Space Applications to the regional centres for space science and technology education, affiliated with the United Nations, including the Network of Space Science and Technology Education and Research Institutions of Central Eastern and South-Eastern Europe, the Working Group of the Whole agreed that the regional centres should be invited to report to it, through the Office for Outer Space Affairs, on their accomplishments, including the list of courses held, the number of participants in their courses, progress made in implementing the recommendations of UNISPACE III and the accomplishments of course participants following the completion of the courses.

36. Regarding the organization of an annual public forum to inform the general public of space activities, the Working Group of the Whole agreed that the symposia and technical presentations organized during the annual session of the Subcommittee provided opportunities for the general public to be informed of recent developments in space activities by the participants. The Working Group of the Whole also agreed that the United Nations Information Service of the United Nations Office at Vienna should be requested to arrange for relevant public events in advance.

37. With regard to the programmes to be initiated to promote the use of satellite communications and Earth observation data for disaster management, the Working Group of the Whole agreed that the use of such data should also be promoted for the protection of the environment.

B. Draft provisional agenda of the Scientific and Technical Subcommittee at its thirty-eighth session, in 2001

38. The Working Group of the Whole noted that the General Assembly, in its resolution 54/67, had welcomed the new approach taken by the Committee on the Peaceful Uses of Outer Space in composing the agenda of the Scientific and Technical Subcommittee.[b] The Working Group of the Whole also noted that, in accordance with resolution 54/67, the Subcommittee would submit its proposal to the Committee for a draft provisional agenda for the thirty-eighth session of the Subcommittee, in 2001.

39. The Working Group of the Whole had before it proposals submitted by Canada on behalf of Australia, Austria, India, the Russian Federation and the United States (A/AC.105/C.1/2000/CRP.3/Rev.1), by China, India and Morocco (A/AC.105/C.1/2000/CRP.7) and by Japan (A/AC.105/C.1/2000/CRP.11) for agenda items to be considered under work plans. The Working Group of the Whole noted that an item entitled "Regional implications of global climate change" had been proposed by Egypt and items entitled "International cooperation in the use of space systems for global search and rescue" and "Government and private activities to promote education in space science and engineering" had been proposed by the United States for inclusion in the agenda of the Subcommittee as single issues and items for discussion. As for the specific subject for the item on space debris to be considered in 2001, the Working Group of the Whole noted that the United States, in a working paper entitled "Proposal for consideration of matters related to space debris by the Scientific and Technical Subcommittee" (A/AC.105/C.1/L.236), had proposed "Launch vehicle orbital debris mitigation practices" and that Germany had proposed "Cost-benefits of debris mitigation measures" (A/AC.105/C.1/L.238), while Italy had proposed "International cooperation in human spaceflight" as a regular item, to be considered at every session of the Subcommittee. The Working Group of the Whole also had before it a conference room paper submitted by Canada, France, Germany, Greece, Italy, Japan, the Russian Federation and the United States concerning the continuation of work on space debris in 2001 (A/AC.105/C.1/2000/CRP.18).

40. The Working Group of the Whole agreed that a new item, entitled "Means and mechanisms for strengthening inter-agency cooperation and increasing the use of space applications and services within the United Nations system and among United Nations specialized agencies and bodies", should be considered by the Subcommittee commencing with its session in 2001 according to the following three-year work plan:

2001 An analysis of the current levels of usage of space applications and services within the United Nations system, including one day for presentations by appropriate United Nations entities and Member States that undertake cooperative activities with those entities; and an examination of the utility of space applications and services for increasing, with regard to space activities, the effectiveness, efficiency and coordination of the operations of United Nations entities

2002 An identification of the barriers to greater use of space applications and services within the United Nations system and an examination of specific means and mechanisms to eliminate those barriers

2003 The development of specific and concrete proposals and, as appropriate, action plans for strengthening inter-agency cooperation in the use of space within the United Nations system and for increasing the use of space applications and services within the system in general and among particular United Nations entities

The Working Group of the Whole agreed that, at its forty-third session, in 2000, the Committee should recommend to the General Assembly at its fifty-fifth session that it request all United Nations entities concerned to provide the Office for Outer Space Affairs with appropriate information in response to a list of questions that the Office would prepare for approval by the Committee at its forty-third session, with the objective of increasing the effectiveness, efficiency and coordination of the space activities of the agencies and bodies of the United Nations system.

41. The Working Group of the Whole agreed that a new item, entitled "Implementation of an integrated, space-based global natural disaster management system", should be considered by the Subcommittee commencing with its session in 2001 according to the following three-year work plan:

2001 Review of the types of natural disasters being faced and the extent of the application of space-based services being utilized for their mitigation (Different countries are to be invited to make presentations on the subject.)

2002 Review of existing and proposed satellite and data distribution systems that can be used operationally for disaster management and identification of gaps in those systems
(The review could also extend to pilot projects undertaken by various space agencies, international organizations and Governments through technical presentations. The Committee on Earth Observation Satellites and others could be invited to make presentations on their efforts and studies.)

2003 Review of possible global operational structures to handle natural disaster management, making maximum use of existing and planned space systems

The Working Group of the Whole recommended that the Secretariat invite Member States and international organizations to submit to the Subcommittee at its thirty-eighth session information on the subject to be discussed at that session in accordance with the above work plan.

42. The Working Group of the Whole recommended the following as the draft provisional agenda for the thirty-eighth session of the Subcommittee:

1. General exchange of views and introduction to reports submitted on national activities.

2. United Nations Programme on Space Applications following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III).

3. Matters relating to remote sensing of the Earth by satellite, including applications for developing countries and monitoring of the Earth's environment.

4. Items to be considered under work plans:

(a) Use of nuclear power sources in outer space
(Second year of the work plan: review of national and international processes, proposals and standards and national working papers relevant to the launch and peaceful use of nuclear power sources in outer space[c]);

(b) Means of and mechanisms for strengthening inter-agency cooperation and increasing the use of space applications and services within and among entities of the United Nations system
(First year of the work plan: an analysis of the current levels of usage of space applications and services within the United Nations system, including one day for presentations by appropriate United Nations entities and Member States that undertake cooperative activities with those entities; and an examination of the utility of space applications and services for increasing, with regard to space activities, the effectiveness, efficiency and coordination of the operations of United Nations entities);

(c) Implementation of an integrated, space-based global natural disaster management system
(First year of the work plan: review of the types of natural disasters being faced and the extent of the application of space-based services being utilized for their mitigation. (Different countries are to be invited to make presentations on the subject.)).

5. Single issues/items for discussion:

(a) Space debris:

(i) Consistent with paragraph 370 of the report of UNISPACE III,[a] stating that the Committee on the Peaceful Uses of Outer Space should give attention to various aspects of space debris, the Scientific and Technical Subcommittee should continue its work on the topic of space debris in 2001;

(ii) It is proposed that, without prejudice to the work on this topic in other forums, the Scientific and Technical Subcommittee should, in particular, examine the question of the costs and benefits of debris mitigation measures. As part of this examination, Member States could report on:

a. The costs of various debris mitigation measures;

b. The consequences, including the economic aspects, of taking no debris mitigation measures;

c. An analysis of the costs and benefits in various debris mitigation scenarios;

(iii) For the thirty-eighth session of the Scientific and Technical Subcommittee, in 2001, the passivation and limitation of mission-related space debris for launch vehicles, including the above-named cost-benefit aspects, would be a suitable subject;

(b) Examination of the physical nature and technical attributes of the geostationary orbit and its utilization and applications, including in the field of space communications, as well as other questions relating to development in space communications, taking particular account of the needs and interests of developing countries;

(c) Government and private activities to promote education in space science and engineering.

6. Draft provisional agenda of the Scientific and Technical Subcommittee at its thirty-ninth session, in 2002, including identification of subjects to be dealt with as single issues/items for discussion or under multi-year work plans.

7. Report to the Committee on the Peaceful Uses of Outer Space.

43. The Working Group of the Whole noted that the following items had also been proposed for inclusion in the agenda for the thirty-eighth session of the Scientific and Technical Subcommittee as single issues/discussion items: (a) international cooperation in human spaceflight (proposal by Italy); (b) international cooperation in the use of space systems for global search and rescue (proposal by the United States); and (c) regional implications of global climate change (proposal by Egypt). The Working Group of the Whole recommended that at the thirty-eighth session of the Subcommittee, those items should be considered for possible inclusion in the agenda for the thirty-ninth session of the Subcommittee, to be held in 2002.

44. The Working Group of the Whole recommended that the Committee on Space Research and the International Astronautical Federation, in liaison with Member States, should be invited to arrange a symposium on the theme "Terrestrial hazards from outer space objects and phenomena" with as wide a participation as possible, to be held during the first week of the thirty-eighth session of the Subcommittee.

C. Other matters

45. The Working Group of the Whole recommended that a colloquium on the theme "The human dimension in space science and technology applications" should be organized during the forty-fourth session of the Committee on the Peaceful Uses of Outer Space, in 2001, with the participation of eminent scientists, sociologists and philosophers and others.

46. The Working Group of the Whole recommended that it be reconvened during the thirty-eighth session of the Scientific and Technical Subcommittee.

Notes

[a] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3).

[b] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* (A/54/20), annex I, sect. A.

[c] A/AC.105/697 and Corr.1, annex III, appendix.

Annex III

Report of the Working Group on the Use of Nuclear Power Sources in Outer Space

1. At its 536th meeting, on 14 February 2000, the Scientific and Technical Subcommittee re-established its Working Group on the Use of Nuclear Power Sources in Outer Space under the chairmanship of Sam A. Harbison (United Kingdom of Great Britain and Northern Ireland).

2. The Working Group had before it the following documents: a note by the Secretariat entitled "National research on space debris, safety of nuclear-powered satellites and problems of collisions of sources with space debris" (A/AC.105/731); two working papers submitted by the Russian Federation, entitled "Collisions between nuclear power sources and space debris" (A/AC.105/C.1/L.233) and "Identification of terrestrial processes and technical standards with a possible relevance to nuclear power sources, including factors distinguishing the use of nuclear power sources in outer space from terrestrial nuclear power applications" (A/AC.105/C.1/L.234); a working paper submitted by the United Kingdom entitled "Technical processes and technical standards relevant to nuclear power sources in space: the position of the United Kingdom of Great Britain and Northern Ireland" (A/AC.105/C.1/L.231); and a working paper submitted by the United States of America entitled "Review of safety processes and standards for the United States space and terrestrial nuclear power systems" (A/AC.105/C.1/L.229).

3. The Working Group also took into account the information provided in the technical presentations on this subject made to the Scientific and Technical Subcommittee by representatives of various member States and the International Atomic Energy Agency (IAEA), reflected in paragraph 23 of the report of the Subcommittee.

4. At the first meeting of the Working Group, on 15 February 2000, its Chairman recalled the tasks before the Working Group and the work plan of its deliberations for developing a framework of safety assurance processes and standards for nuclear power sources in outer space (A/AC.105/697 and Corr.1, annex III, appendix), approved by the Scientific and Technical Subcommittee at its thirty-fifth session. In accordance with the work plan, the Working Group in 2000 was to identify terrestrial processes and technical standards that might be relevant to nuclear power sources, including factors distinguishing nuclear power sources in outer space from terrestrial nuclear applications.

5. The Working Group identified the following classes of terrestrial (including marine) processes that might have relevance to nuclear power sources in outer space: (a) nuclear reactors (stationary and mobile); (b) packaging and transport of radioactive materials; and (c) use of radioactive sources in terrestrial applications. The Working Group agreed to carry out a more in-depth assessment of the relevance of each of the processes.

6. The Working Group identified the following international documents that might be relevant to the safety of nuclear power sources in outer space:

(a) The provisions of the Convention on Nuclear Safety,[a] the Convention on Early Notification of a Nuclear Accident[b] and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;[c]

(b) The recommendations of the International Commission on Radiological Protection;

(c) The relevant Safety Series publications of IAEA;

(d) The reports of the United Nations Scientific Committee on the Effects of Atomic Radiation.

The Working Group agreed that a review of those documents should be carried out within the context of the second year of its work plan in order to identify with more specificity those documents or parts of documents which might be of particular relevance to nuclear power sources in outer space. The Working Group welcomed the offer of IAEA to conduct a preliminary review of the documents and requested the Agency to report on the matter at the thirty-eighth session of the Scientific and Technical Subcommittee, in 2001.

7. The Working Group noted differing approaches in national standards relevant to terrestrial nuclear power sources that had been indicated through the comprehensive reports of certain member States. However, the Working

Group agreed that a significant commonality existed among the various national approaches through their application of and adherence to the provisions of the Convention on Nuclear Safety and the IAEA Safety Fundamentals developed in support of the Convention. The Working Group therefore agreed that a detailed examination of the Convention on Nuclear Safety and the related IAEA documents, particularly the Safety Fundamentals, should be undertaken within the framework of the second year of its work plan.

8. The Working Group agreed that the extent of differences and similarities between the use of nuclear power sources in outer space and terrestrial nuclear applications depended upon the specific nature of the applications in each case. The Working Group therefore noted a number of aspects that warranted further consideration in order to identify the extent to which those aspects might be relevant to the use of nuclear power sources in outer space, including:

(a) Nature of the applications;

(b) Operating environment;

(c) Nature and autonomy of operation of systems;

(d) Quantity of the radioactive material;

(e) Frequency and duration of use;

(f) Distance to, and the effects of normal operation and potential accidents on, populated areas;

(g) Complexity and designed reliability of systems;

(h) Use of passive and/or active systems;

(i) End of service.

9. The Working Group noted that there might be advances in technology and applications of nuclear power sources in outer space that had not yet been developed or envisaged. Reference was made to the multi-year work plan, according to which the review of safety processes and standards would be conducted to provide for the broadest range of existing and future radioisotope power and nuclear reactor power applications (e.g. applications on other celestial bodies such as the Moon).

10. The Working Group agreed that it would be useful, in accordance with the agreed work plan, for representatives of launching States to present at the thirty-eighth session of the Subcommittee, in 2001, a detailed review of the processes carried out to obtain final launch approval in their countries.

11. The Working Group noted that some of the specific proposals in one of the working papers submitted by the Russian Federation (A/AC.105/C.1/L.234) concerning possible amendment of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space (adopted by the General Assembly in its resolution 47/68 of 14 December 1992) should be reserved for possible consideration after completion of the work plan.

12. The Working Group on the Use of Nuclear Power Sources in Outer Space recommended that it be reconvened during the thirty-eighth session of the Scientific and Technical Subcommittee.

Notes

[a] International Atomic Energy Agency, "Convention on Nuclear Safety" (INFCIRC/449).

[b] United Nations, *Treaty Series*, vol. 1439, No. 24404.

[c] Ibid., vol. 1457, No. 24643.

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Committee on the Peaceful Uses of Outer Space

Note verbale dated 13 March 2000 from the Permanent Mission of the United States of America to the United Nations (Vienna) addressed to the Secretary-General

1. The Permanent Mission of the United States of America to the United Nations (Vienna) presents its compliments to the Office for Outer Space Affairs of the Secretariat and has the honour, on behalf of the Government of the United States of America, to notify the Secretary-General, in accordance with article 5, paragraph 1, of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Space Objects Launched into Outer Space (the "Agreement"),[1] that component parts of a space object have been discovered on territory of the United States of America. The object found had washed ashore near Corpus Christi, Texas, and appears to be part of the nose cone of a French Ariane rocket. It bears the following identifying lettering on a circular plate at the interior apex of the cone: "AEROSPATIALE, IE/AX, FLUXMETRE NO. SER.966-332, REF. DE DEF. A5-IK871-A-000 BLOCK CONTROLE: 25-.11.96". An investigation concluded that the object poses no hazard to people and property. It is being held temporarily by local authorities in Corpus Christi.

2. In accordance with article 5 of the Agreement, the Government of the United States of America has also notified the Government of France and invited it to identify the object.

3. The Permanent Mission of the United States of America further has the honour to request that this communication be circulated to Member States as an official document of the Committee on the Peaceful Uses of Outer Space.

Notes

[1] General Assembly resolution 2345 (XXII), annex.

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Committee on the Peaceful Uses of Outer Space

Report of the Legal Subcommittee on its thirty-ninth session, held in Vienna from 27 March to 6 April 2000

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I. Introduction

A. Opening of the session

1. The Legal Subcommittee held its thirty-ninth session at the United Nations Office at Vienna from 27 March to 6 April 2000 under the chairmanship of Vladimír Kopal (Czech Republic).

2. At the opening (622nd) meeting, on 27 March, the Chairman made a statement briefly describing the new agenda structure and the work to be undertaken by the Subcommittee at its thirty-ninth session. The Chairman's statement is contained in an unedited verbatim transcript (COPUOS/Legal/T.622).

B. Adoption of the agenda

3. At its opening meeting, the Legal Subcommittee adopted the following agenda:

1. Opening of the session.
2. Statement by the Chairman.
3. General exchange of views.
4. Status of the international treaties governing the uses of outer space.
5. Information on the activities of international organizations relating to space law.
6. Matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union.
7. Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space.
8. Review of the status of the five international legal instruments governing outer space.
9. Review of the concept of the "launching State".
10. Proposals to the Committee on the Peaceful Uses of Outer Space for new items to be considered by the Legal Subcommittee at its fortieth session.

C. Attendance

4. Representatives of the following States members of the Subcommittee attended the session: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Cuba, Czech Republic, Ecuador, Egypt, France, Germany, Greece, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Italy, Japan, Kazakhstan, Kenya, Lebanon, Mexico, Morocco, Netherlands, Nigeria, Philippines, Poland, Portugal, Republic of Korea, Romania, Russian Federation, South Africa, Spain, Sweden, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America and Uruguay.

5. Representatives of the following specialized agencies of the United Nations system and other international organizations attended the session: United Nations Educational, Scientific and Cultural Organization (UNESCO), International Telecommunication Union (ITU), European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), European Space Agency (ESA), International Astronautical Federation (IAF) and International Mobile Satellite Organization (IMSO).

6. At the 622nd, 624th and 629th meetings, on 27, 28 and 30 March, the Chairman informed the Subcommittee that requests had been received from the Permanent Representatives of Bolivia, Costa Rica, Guatemala, Panama, Peru, Saudi Arabia, Slovakia and Sri Lanka to attend the session. The Subcommittee agreed that, since the granting of observer status was the prerogative of the Committee on the Peaceful Uses of Outer Space, it could take no formal decision on the matter, but that the representatives of those countries might attend the formal meetings of the Subcommittee and could direct requests for the floor to the Chairman, should they wish to make statements.

7. A list of representatives of States members of the Subcommittee, States not members of the Subcommittee, specialized agencies and other organizations attending the session and of staff members of the secretariat of the Subcommittee is contained in document A/AC.105/C.2/INF/32.

D. Organization of work

8. In accordance with decisions taken at its opening meeting, the Legal Subcommittee organized its work as follows:

(a) In accordance with the recommendation endorsed by the Committee on the Peaceful Uses of Outer Space,[1] the Subcommittee agreed to suspend, for the current session, its Working Group on agenda item 7;

(b) The Subcommittee re-established its Working Group on agenda item 6, open to all members of the Subcommittee, and elected Héctor Raúl Pelaez (Argentina) to serve as its Chairman;

(c) In accordance with the work plan agreed upon by the Committee on the Peaceful Uses of Outer Space[2] and endorsed by the General Assembly, in its resolution 54/67 of 6 December 1999, the Subcommittee established a working group on agenda item 8, open to all members of the Subcommittee, and elected Kai-Uwe Schrogl (Germany) to serve as its Chairman;

(d) The Subcommittee began its work each day with a plenary meeting to hear delegations wishing to address it and then it adjourned and reconvened, when appropriate, as a working group.

9. At the opening meeting, the Chairman made a statement concerning the utilization of conference services by the Subcommittee. He drew attention to the importance that the General Assembly and the Committee on Conferences attached to the effective utilization of conference services by all United Nations deliberative bodies. In view of that, the Chairman proposed and the Subcommittee agreed that a flexible organization of work should continue to serve as the basis for organizing the work of the Subcommittee with a view to making fuller use of the conference services available.

10. The Subcommittee noted with satisfaction that a symposium entitled "Legal Aspects of Commercialization of Space Activities", sponsored by the International Institute of Space Law (IISL) in cooperation with the European Centre for Space Law (ECSL), had been held following the 623rd meeting of the Legal Subcommittee, on 27 March 2000. The coordinator of the symposium was E. Fasan of IISL. Presentations were made by S. Doyle on "Space law and commercialization: overview of the current law in the light of new commercial developments", P. van Fenema on "Launch services", R. Jakhu on "Telecommunication and broadcasting" and G. Catalano Sgrosso on "Remote sensing". The Subcommittee agreed that IISL and the Centre should be invited to hold a further symposium on space law at the fortieth session.

11. The Legal Subcommittee recommended that its fortieth session be held from 2 to 12 April 2001.

E. Adoption of the report of the Legal Subcommittee

12. The Subcommittee held a total of 17 meetings. The views expressed at those meetings are contained in unedited verbatim transcripts (COPUOS/Legal/T.622-638).

13. At its 638th meeting, on 6 April, the Subcommittee adopted the present report and concluded the work of its thirty-ninth session.

II. General exchange of views

14. Statements were made by representatives of the following member States during the general exchange of views: Argentina, Australia, Brazil, China, Colombia, Cuba, Czech Republic, Egypt, France, Germany, Indonesia, Iran (Islamic Republic of), Japan, Morocco, Republic of Korea, Russian Federation and United States. The representative of Guatemala (on behalf of the Group of Latin American and Caribbean States) also made a statement. The views expressed by those representatives are contained in unedited verbatim transcripts (COPUOS/Legal/T.622-625).

15. At the 622nd meeting, on 27 March, the Director of the Office for Outer Space Affairs made a statement reviewing the work of the Office relating to the Legal Subcommittee and the development of space law.

16. The Subcommittee noted with satisfaction the creation by the Office for Outer Space Affairs of a preliminary database of publicly available national legislation relating to outer space and agreed that the Secretariat should continue its efforts to maintain and further develop the database.

17. The view was expressed that, since 2001 would mark the fortieth anniversary of the first flight of humans into outer space and the fortieth session of the Legal Subcommittee, the Subcommittee should consider how those events could be appropriately celebrated. In addition,

that delegation suggested that the Legal Subcommittee or the Committee on the Peaceful Uses of Outer Space should consider the possibility of contributing to the celebration of World Space Week (4-10 October 2000) and the final year of the twentieth century by holding a short special session at that time in New York.

18. Some delegations expressed the view that it would be desirable to expand the membership of the Committee on the Peaceful Uses of Outer Space and to allow the rotating members of the Committee to assume permanent membership.

III. Status of the international treaties governing the uses of outer space

19. At the 622nd meeting, on 27 March, the Chairman made an introductory statement on agenda item 4 and drew the attention of the Subcommittee to the fact that, on the basis of a recommendation of the Committee on the Peaceful Uses of Outer Space at its forty-second session, in 1999, the General Assembly, in its resolution 54/67, had endorsed the recommendation of the Committee that the Subcommittee consider this new agenda item as a regular item in order to provide an opportunity for reports on any additional signature or ratification as well as on application of the outer space treaties.

20. The Chairman reported briefly to the Subcommittee on the current status of signatures and ratifications of the international treaties governing the use of outer space, in accordance with information provided to the Secretariat by the depositaries of those treaties. With the accessions of Indonesia and Liechtenstein and the succession of Saint Vincent and the Grenadines, the number of signatures and ratifications of the five United Nations treaties governing outer space was, as of February 2000, as follows:

(a) The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (General Assembly resolution 2222 (XXI), annex, the "Outer Space Treaty") had 96 States parties and had been signed by 27 other States;

(b) The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (resolution 2345 (XXII), annex, the "Rescue Agreement") had 87 States parties and had been signed by 26 other States;

(c) The Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI), annex, the "Liability Convention") had 81 States parties and had been signed by 26 other States;

(d) The Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex, the "Registration Convention") had 42 States parties and had been signed by 4 other States;

(e) The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (resolution 34/68, annex, the "Moon Agreement") had 9 States Parties and had been signed by 5 other States.

In addition, one intergovernmental organization had declared its acceptance of the rights and obligations provided for in the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space; two intergovernmental organizations had declared their acceptance of the rights and obligations of the Convention on International Liability for Damage Caused by Space Objects; and two intergovernmental organizations had declared their acceptance of the rights and obligations of the Convention of Registration of Objects Launched into Outer Space.

21. It was noted that the information contained in *United Nations Treaties and Principles on Outer Space: a Commemorative Edition* (A/AC.105/722), including signatures and ratifications of the five United Nations treaties governing outer space, had been updated by the Secretariat and the additional information distributed as an insert to that booklet (A/AC.105/722/Add.1).

22. The Subcommittee welcomed the reports of member States on the current status of action being undertaken by States concerning accession to the five international legal instruments governing outer space and on action planned in that regard.

23. The Subcommittee had before it, for information, copies of notifications made in accordance with article 5 of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects launched into Outer Space by the Governments of Japan (A/AC.105/735) and the United States (A/AC.105/737) providing information on component parts of a space object that had returned to Earth in territory under their respective jurisdiction.

24. The view was expressed that, although the provisions of the treaties were managing well with the increasingly complex activities of outer space, member States should re-examine their own domestic legal regimes in order to

ensure that the provisions of the treaties were being properly implemented and, if necessary, should put in place appropriate domestic regulatory mechanisms to ensure effective compliance.

25. Some delegations expressed the view that the time had come for the Subcommittee to discuss the appropriateness and desirability of drafting a single comprehensive convention on space law, such as had been done in the case of the United Nations Convention on the Law of the Sea.[3]

26. The full text of the statements made by delegations during the discussion on agenda item 4 is contained in unedited verbatim transcripts (COPUOS/Legal/T.622-626).

IV. Information on the activities of international organizations relating to space law

27. At the 624th meeting, on 28 March, the Chairman made an introductory statement on agenda item 5 and drew attention to the fact that this was a new regular agenda item agreed upon by the Committee on the Peaceful Uses of Outer Space at its forty-second session and subsequently endorsed by the General Assembly in its resolution 54/67.

28. The Legal Subcommittee noted with satisfaction that various international organizations had been invited by the Secretariat to report to the Subcommittee on their activities relating to space law and agreed that a similar invitation should be extended by the Secretariat for the fortieth session of the Subcommittee, in 2001.

29. The Legal Subcommittee had before it two conference room papers (A/AC.105/C.2/2000/CRP.4 and A/AC.105/C.2/2000/CRP.10), which contained compilations of written reports from the following organizations of the United Nations system and other international organizations on their activities relating to space law: ITU, World Intellectual Property Organization, ECSL, ESA, IISL, IMSO and International Law Association.

30. In addition, representatives of the following international organizations reported to the Subcommittee on their activities relating to space law: ITU, ECSL, ESA, EUMETSAT, IISL, IMSO and International Institute for the Unification of Private Law (Unidroit).

31. The Subcommittee noted that the 43rd IISL Colloquium on the Law of Outer Space and the ninth Manfred Lachs Space Law Moot Court Competition would be held in Rio de Janeiro, Brazil, from 2 to 6 October 2000.

32. Some delegations expressed the view that the work being carried out under the auspices of Unidroit on the development of a new international regime governing security interests in high-value mobile equipment, such as space property, was most valuable and enjoyed considerable support, including within the private sector. The view was expressed that consideration of issues relating to such work should be placed as a single issue/item for discussion on the agenda of the Legal Subcommittee at its fortieth session.

33. The view was expressed that space-related intergovernmental organizations and their member States should consider the requirements for acceptance by those organizations of the rights and obligations under the provisions of certain of the United Nations treaties relating to outer space and the possible steps that might be taken in that regard to encourage wider adherence of such organizations to international space law.

34. The view was expressed that additional information relating to how the consequences of the privatization of space-related international organizations were being dealt with under the United Nations treaties relating to outer space would be most welcome.

35. The full text of the statements made by delegations during the discussion on agenda item 5 is contained in unedited verbatim transcripts (COPUOS/Legal/T.624-628 and 634).

V. Matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union

36. At the 624th meeting, on 28 March, the Chairman made an introductory statement on agenda item 6.

37. The Chairman drew attention to the fact that the General Assembly, in its resolution 54/67, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space[4] that the Legal Subcommittee, at its thirty-ninth session, taking into account the concerns of all countries, in particular those of developing countries, continue, through its working group, its consideration of matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of ITU.

38. The Legal Subcommittee had before it the following documents:

(a) Report of the Legal Subcommittee on its thirty-eighth session (A/AC.105/721);

(b) Report of the Scientific and Technical Subcommittee on its thirty-seventh session (A/AC.105/736);

(c) Note by the Secretariat entitled "Questionnaire on possible legal issues with regard to aerospace objects: replies from member States" (A/AC.105/635 and Add.1-5), which had been before the Legal Subcommittee at its thirty-seventh session;

(d) Working paper entitled "Some considerations concerning the utilization of the geostationary satellite orbit" (A/AC.105/C.2/L.200 and Corr.1), submitted by Colombia to the Subcommittee at its thirty-fifth session;

(e) Note by the Secretariat entitled "Comprehensive analysis of the replies to the questionnaire on possible legal issues with regard to aerospace objects" (A/AC.105/C.2/L.204), which had been before the Subcommittee at its thirty-sixth session.

39. The attention of the Legal Subcommittee was also drawn to two documents that had been updated by the Secretariat, in cooperation with ITU, in response to the recommendation of the Subcommittee at its thirty-eighth session (A/AC.105/721, para. 41). The first of the two documents was entitled "An analysis of the compatibility of the approach contained in the working paper entitled 'Some considerations concerning the utilization of the geostationary orbit' with the existing regulatory procedures of the International Telecommunication Union" (A/AC.105/C.2/L.205/Rev.1) and the second was a conference room paper containing a compendium of documentation relating to the geostationary orbit (A/AC.105/C.2/2000/CRP.3/Rev.1).

40. Some delegations expressed the view that as the item on definition and delimitation of outer space and the utilization of the geostationary orbit dealt with two different issues, those issues could be divided into two sub-items and considered separately, which would facilitate the work of the Legal Subcommittee relating to the item.

41. Some delegations expressed the view that recent technological developments made it necessary for the Legal Subcommittee to continue its consideration of the question of the definition and delimitation of outer space, in particular relating to aerospace objects, by examining the documents that had been prepared relating to the issue and submitted to the Legal Subcommittee at previous sessions.

42. The view was expressed that in order to facilitate the discussion of aerospace objects, the Secretariat could update the analysis of replies received from member States since the Legal Subcommittee last considered the document entitled "Questionnaire on possible legal issues with regard to aerospace objects: replies from member States" (A/AC.105/635 and Add.1-5). The view was also expressed that it would be useful to the discussion of aerospace objects if the Secretariat investigated the possibility of making available to the Subcommittee the materials of the symposium on aerospace objects that had been held at the University of Rome.

43. The view was expressed that it was premature to develop any definition or delimitation of outer space when the lack of such a definition or delimitation had not caused any problems in conducting space activities and that an arbitrary and artificial definition or delimitation of outer space would render international law less useful and

effective. Another delegation expressed the view that a definition and delimitation of outer space were indispensable for member States to have a legal basis on which to regulate their national territories, as well as to resolve issues arising from collisions that could occur between aerospace objects and aircraft.

44. As mentioned in paragraph 8 (b) above, at its 622nd meeting, on 27 March, the Legal Subcommittee re-established its Working Group on agenda item 6 under the chairmanship of Héctor Raúl Pelaez (Argentina).

45. The Legal Subcommittee noted with appreciation the efforts undertaken by France and the other sponsors of the paper entitled "Some aspects concerning the use of the geostationary orbit" (A/AC.105/C.2/2000/CRP.7), which had been submitted to the Working Group in order to reach consensus on the question of the utilization of the geostationary orbit.

46. The Legal Subcommittee welcomed the agreement reached by the Working Group on the text of the paper contained in the conference room paper (A/AC.105/C.2/2000/CRP.7). The amended text, as adopted by the Working Group, was considered by the Subcommittee as a conference room paper, entitled "Some aspects concerning the use of the geostationary orbit" (A/AC.105/C.2/2000/CRP.9).

47. At its 631st meeting, on 31 March, the Legal Subcommittee finalized and adopted the second conference room paper. The agreed text of the paper (A/AC.105/C.2/L.221) is attached as annex III to the present report.

48. The Working Group on agenda item 6 held three meetings. At the 638th meeting, on 6 April, the Legal Subcommittee endorsed the report of the Working Group, which is contained in annex I to the present report.

49. The full text of the statements made by delegations during the discussion on agenda item 6 is contained in unedited verbatim transcripts (COPUOS/Legal/T.624-631).

VI. Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space

50. At the 625th meeting, on 28 March, the Chairman made an introductory statement on agenda item 7.

51. The Chairman drew attention to the fact that the General Assembly, in its resolution 54/67, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Legal Subcommittee continue its consideration of review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space (resolution 47/68), as a single issue and item for discussion.

52. The Legal Subcommittee recalled its recommendation, made at its thirty-eighth session and subsequently endorsed by the Committee,[1] that at its thirty-ninth session, consideration by the Working Group on the Principles Relevant to the Use of Nuclear Power Sources in Outer Space again be suspended pending the results of the work of the Scientific and Technical Subcommittee, without prejudice to the possibility of reconvening the Working Group if, in the opinion of the Legal Subcommittee, sufficient progress had been made in the Scientific and Technical Subcommittee at its thirty-seventh session, in 2000, to warrant the reconvening of the Working Group.

53. As mentioned in paragraph 8 (a) above, at its 622nd meeting, the Legal Subcommittee agreed to suspend, for the thirty-ninth session, its Working Group on agenda item 7.

54. The Subcommittee had before it, for information, copies of a notification made in accordance with principle 4 of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space by the Government of the United States (A/AC.105/677 and Add.1) providing information regarding the availability of the Cassini spacecraft safety assessment results.

55. Some delegations welcomed the work carried out by the Scientific and Technical Subcommittee at its thirty-seventh session on the item entitled "Use of nuclear power sources in outer space", under a multi-year work plan, the first year of which identified terrestrial processes and technical standards that might be relevant to nuclear power sources, including factors distinguishing nuclear power sources in outer space from terrestrial nuclear applications.

56. The view was expressed that various conventions adopted under the auspices of the International Atomic Energy Agency and documents published by the Agency were relevant to the work plan in the Scientific and Technical Subcommittee and that the views of the Agency were welcome in that regard.

57. The full text of the statements made by delegations during the discussion on agenda item 7 is contained in unedited verbatim transcripts (COPUOS/Legal/T.625-627).

VII. Review of the status of the five international legal instruments governing outer space

58. At the 626th meeting, on 29 March, the Chairman made an introductory statement on agenda item 8.

59. The Chairman drew attention to the fact that the General Assembly, in its resolution 54/67, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Legal Subcommittee continue its review of the status of the five international legal instruments governing outer space in accordance with the proposed work plan for the agenda item that had been approved by the Subcommittee at its thirty-sixth session.

60. The Legal Subcommittee noted that 2000 was the final year of its agreed work plan and, accordingly, that at its current session the Subcommittee should, on the basis of the recommendations of the Working Group, consider and implement as appropriate the measures considered adequate to achieve the widest and fullest adherence to the treaties relating to outer space.

61. The Legal Subcommittee recalled the deliberations and recommendations of its Working Group on the item, convened at its thirty-eighth session under the chairmanship of Vassilios Cassapoglou (Greece). The report of the Working Group appeared in the report of the Subcommittee on its thirty-eighth session (A/AC.105/721, annex II).

62. The Legal Subcommittee also had before it:

(a) Note by the Secretariat on the review of the status of the five international legal instruments governing outer space (A/AC.105/C.2/L.210 and Add.1);

(b) Working papers on the subject submitted to the Subcommittee at its thirty-seventh session by:

(i) Germany, on behalf of the member States of ESA and States having signed cooperation agreements with ESA (A/AC.105/C.2/L.211/Rev.1, paras. 2-9);

(ii) The Russian Federation (A/AC.105/C.2/L.213).

63. The view was expressed that the structure proposed by the delegation of Mexico for the report of the Working Group at the thirty-eighth session of the Legal Subcommittee could form the basis for the final report of the Subcommittee on the item.

64. The view was expressed that the recommendations appearing in paragraphs 13 (a) and (c) of the previous report of the Working Group on this item (A/AC.105/721, annex II) were the most important and should be the focus of the Legal Subcommittee's work in the final year of the work plan. That delegation was also of the view that the Subcommittee should make a clear call for States seriously to consider adhering to what it termed "the four core instruments". In addition, States that had accepted those instruments should examine the extent to which they were being effectively implemented at the national level.

65. The view was expressed that while States should consider making a declaration accepting the binding nature of the decisions of the Claims Commission in the event of a dispute under the provisions of the Liability Convention, that was not necessarily the best process in view of the wide variety of legal and other mechanisms that might be available for settling space-related disputes.

66. Some delegations expressed the view that the Moon Agreement should be examined further with a view to identifying the reasons for its low level of ratification and signature by Member States and international organizations and to considering possible measures to address the situation. The view was expressed that, in that regard, the Secretariat should invite comments from those Member States and international organizations which had not ratified or accepted the Agreement as to their reasons for not having done so.

67. Some delegations expressed the view that, with the rapid evolution of technology and of the organization of space activities, the Legal Subcommittee needed to maintain its leading role in the development of legal principles and in the identification of improvements to the existing legal principles and instruments governing the peaceful uses of outer space. In that regard, the view was expressed that the Legal Subcommittee should engage in a discussion with a view to formulating detailed interpretations of the

existing legal principles and concepts, taking into account the experience acquired through application of the treaties as well as progress in and evolution of technologies and the law.

68. The view was expressed that if it was decided that any of the five international legal instruments governing outer space required amendment, such amendment could be formally proposed only by the States parties to the instruments in question, in accordance with international law and the actual provisions of the instruments. The Legal Subcommittee could not, even by consensus, make any such proposals for amendment or revision of the instruments, but was limited to simply assisting the States parties with an objective analysis. However, the view was also expressed that that did not conflict with the tasks currently being undertaken by the Subcommittee under the item.

69. The view was reiterated that the five international legal instruments governing outer space were, by their nature, interdependent and that a holistic approach should therefore be taken in their review and analysis in relation to possible future revision and amendment. In addition, that delegation was of the view that, should such revision or amendment be required, there would be no other choice but to develop a single, comprehensive treaty on outer space.

70. The view was expressed that the achievement of universal acceptance and implementation at the domestic level of the five international legal instruments governing outer space should remain the first priority, before seeking to reach any consensus on the need to improve the space law regime.

71. The view was expressed that some clarification of specific terms within the legal instruments governing outer space was required in order to strengthen their application. That delegation was of the view that such clarification should be made by means of annexes to the existing instruments or by other similar means appropriate under international law.

72. The view was expressed that the growing role and legal status of international organizations in space-related activities should be taken into account in any review of the international legal instruments governing outer space. That delegation was also of the view that the Secretariat should invite comments from those international organizations in that regard for consideration by the Subcommittee.

73. The view was expressed that, in order to raise awareness and to encourage States to consider ratifying or acceding to the five legal instruments governing outer space, focused and effective symposia and forums should be organized with the participation of representatives of Member States, international organizations and the Office for Outer Space Affairs to provide technical advice concerning the benefits that those States would enjoy from making such ratifications or accessions.

74. The view was expressed that the resulting intergovernmental discussions in the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee were themselves a valuable consequence of the three-year work plan on the item, which had focused attention on the five legal instruments as the core of international space law.

75. The Legal Subcommittee endorsed the recommendations of its Working Group that, in order to achieve the fullest adherence to the five international instruments governing outer space:

(a) States that had not yet become parties to the five international treaties governing outer space should be invited to consider ratifying or acceding to those treaties in order to achieve the widest applicability of the principles and to enhance the effectiveness of international space law;

(b) States should be invited to consider making a declaration in accordance with paragraph 3 of General Assembly resolution 2777 (XXVI) of 29 November 1971, thereby binding themselves on a reciprocal basis to the decisions of the Claims Commission established in the event of a dispute in terms of the provisions of the Liability Convention;

(c) The issue of the strict compliance by States with the provisions of the international legal instruments governing outer space to which they were currently parties should be examined further with a view to identifying measures to encourage full compliance, taking into account the interrelated nature of the principles and rules governing outer space.

76. The full text of the statements made by delegations during the discussion on agenda item 8 is contained in unedited verbatim transcripts (COPUOS/Legal/T.626-633).

VIII. Review of the concept of the "launching State"

77. At the 629th meeting, on 30 March, the Chairman made an introductory statement on agenda item 9.

78. The Chairman drew attention to the fact that the General Assembly, in its resolution 54/67, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Legal Subcommittee consider an agenda item entitled "Review of the concept of the 'launching State'", in accordance with the three-year work plan adopted by the Committee,[2] and that the Subcommittee establish a working group to consider the item.

79. In accordance with the work plan adopted by the Committee, the first year of the work on this item was allocated to special presentations on new launch systems and ventures. The Legal Subcommittee decided that the presentations should be made within the Working Group on agenda item 9.

80. The view was expressed that new launching technology, including mobile launchers, created some uncertainty in application of the concept of the "launching State" under the Liability Convention and the Registration Convention. That delegation was of the view that development of effective national legislation to implement the provisions of the Liability Convention was important to address any future launching accidents.

81. The view was expressed that the reason for including the item on the agenda, the privatization of space activities, was not an entirely new matter. Under article VI of the Outer Space Treaty, States bore international responsibility for all national activities in outer space, including activities carried out by non-governmental entities. Those activities required authorization and continuing supervision by the appropriate State. Both the Liability Convention and the Registration Convention contained adequate provisions for successfully handling any specific situation involving a private space launch. While it might be generally helpful to have an agreed definition of what "procuring" a space launch meant for the purposes of the above instruments, it should be realized that such an interpretation by the Legal Subcommittee would be a doctrinal one, because only States parties to an international treaty had the authority to provide an authentic interpretation of that treaty. That delegation also recalled that private companies and other non-governmental organizations were not subjects of international law and that the role of States under agreements relating to outer space was not undermined by the increasing activities of private entities in outer space.

82. The view was also expressed that, according to its mandate from the Committee on the Peaceful Uses of Outer Space, the Legal Subcommittee was to review the application, rather than provide interpretation, of the concept of the launching State, following the agreed three-year work plan. Some delegations noted that only States parties to treaties, rather than other bodies not necessarily composed of States parties, could establish authoritatively the manner in which those treaties were to be applied and interpreted.

83. The view was expressed that a State authorizing the launch of a space object, for instance through a licence or official registration, was a State "procuring the launch" of a space object under the Liability Convention and the Registration Convention.

84. However, the view was also expressed that authorization was not necessarily synonymous with procurement. That delegation was of the view that the language of the treaties relating to outer space was the most authoritative expression of the meaning of the treaties, supplemented in case of ambiguity by the actual practice of States in implementing the treaties.

85. The view was expressed that the topic for discussion under the second year of the work plan for "Review of the concept of the 'launching State'" should include consideration not only of the Liability Convention and the Registration Convention, but also of the other main treaties relating to outer space.

86. The attention of the Subcommittee was drawn to the fact that article 6 of the Rescue Agreement contains the term "Launching authority", which refers, *inter alia*, to international intergovernmental organizations responsible for launching.

87. The Subcommittee requested the Secretariat to prepare a paper setting out the key elements of existing national space legislation that, in the Secretariat's judgement, illustrated how States were implementing, as appropriate, their responsibilities to authorize and provide continuing supervision of non-governmental entities in outer space. The paper should also include additional information, such as information on state practice drawn, *inter alia*, from the special presentations on new launch systems and ventures at the thirty-ninth session of the Subcommittee. The paper could be prepared with assistance, as required, from member States and international organizations. The paper could be issued, if the Secretariat

considered it appropriate, as a single publication together with the compilation of documents requested by the Working Group under agenda item 9 (see annex II, para. 15). The paper could provide a starting point for discussion under the second year of the work plan (2001).

88. As mentioned in paragraph 8 (c) above, at its 622nd meeting, the Legal Subcommittee established a Working Group on agenda item 9. At its 629th meeting, the Legal Subcommittee elected Kai-Uwe Schrogl (Germany) Chairman of the Working Group.

89. The Working Group on agenda item 9 held four meetings. At its 638th meeting, on 6 April, the Legal Subcommittee endorsed the report of the Working Group, which is contained in annex II to the present report.

90. The full text of the statements made by delegations during the discussion on agenda item 9 is contained in unedited verbatim transcripts (COPUOS/Legal/T.629-637).

IX. Proposals to the Committee on the Peaceful Uses of Outer Space for new items to be considered by the Legal Subcommittee at its fortieth session

91. At the 629th meeting, on 30 March, the Chairman made an introductory statement on agenda item 10.

92. The Chairman drew attention to the fact that this was a new agenda item agreed upon by the Committee on the Peaceful Uses of Outer Space at its forty-second session and subsequently endorsed by the General Assembly in its resolution 54/67. The new agenda item in fact replaced the informal consultations on new items for the agenda that the Legal Subcommittee had held at its previous sessions.

93. The Legal Subcommittee noted that, in view of the new agenda structure agreed upon by the Committee on the Peaceful Uses of Outer Space at its forty-second session, it would also need to consider under this item whether to propose retaining current items 7 and 8 on the agenda of its fortieth session.

94. The Legal Subcommittee recalled that, at its thirty-seventh and thirty-eighth sessions, in 1998 and 1999, respectively, the following items had been discussed for possible inclusion in its agenda:

(a) Commercial aspects of space activities (e.g. property rights, insurance and liability), proposed by the delegation of Argentina;

(b) Review of existing norms of international law applicable to space debris, proposed by the delegation of the Czech Republic;

(c) Legal aspects of space debris, proposed by the delegations of Brazil and the Czech Republic;

(d) Comparative review of the principles of international space law and international environmental law, proposed by the delegation of Chile;

(e) Review of the Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting and the Principles Relating to Remote Sensing of the Earth from Outer Space, with a view to possibly transforming those texts into treaties in the future, proposed by the delegation of Greece;

(f) Improvement of the Convention on Registration of Objects Launched into Outer Space, proposed by the delegation of Germany on behalf of the member States of ESA and States having signed cooperation agreements with ESA;

(g) Examination of the Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 as a model to encourage wider accession to the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, proposed by the delegation of the Netherlands;

(h) Review of the concept of the "launching State", proposed by the delegation of Germany.

95. The Legal Subcommittee also recalled that:

(a) Spain had withdrawn its proposal entitled "Comparative study of the provisions of the law of the sea and international space law", noting that it had been similar to the proposal by the Netherlands;

(b) Brazil, Greece and the Netherlands had announced that their proposals could be considered at a later stage, as other items being considered could have higher priority;

(c) Argentina had submitted a working paper (A/AC.105/C.2/L.215) containing a work plan for the item that it had proposed, which had subsequently been annexed to the report of the Legal Subcommittee on the work of its thirty-eighth session (A/AC.105/721, annex III);

(d) Chile had announced that a work plan would be submitted with regard to its proposal;

(e) At its forty-second session, the Committee on the Peaceful Uses of Outer Space had agreed that a new item entitled "Review of the concept of the 'launching State'" should be included in the agenda of the Legal Subcommittee.[2] As a consequence of that agreement, the two proposals by Germany were no longer under consideration.

96. The Legal Subcommittee noted that Chile had withdrawn its proposal from consideration for inclusion in the agenda of the fortieth session of the Subcommittee as other items being considered could have higher priority, but that it would submit a working paper on the proposal at the fortieth session of the Subcommittee, in 2001.

97. The Legal Subcommittee noted that Argentina had proposed, as an alternative to the proposal contained in its working paper (A/AC.105/C.2/L.215), that a new single issue/item for discussion entitled "Commercial aspects of space activities" be included in the agenda of the fortieth session of the Legal Subcommittee.

98. The Legal Subcommittee noted that Greece had joined in sponsoring the proposal made by the Czech Republic of a new item entitled "Review of existing norms of international law applicable to space debris".

99. At the 632nd meeting, on 3 April, the delegation of the Russian Federation submitted a working paper (A/AC.105/C.2/L.220) containing a proposal for a new single issue/item for discussion entitled "Advisability of developing a single comprehensive United Nations convention on the law of outer space" to be included in the agenda of the fortieth session of the Legal Subcommittee.

100. During the course of discussions, the following additional proposals were made for new single issues/items for discussion to be included in the agenda of the fortieth session of the Legal Subcommittee:

(a) Matters relating to the low level of ratification of the Moon Agreement, proposed by the delegation of Australia;

(b) Consideration of the preliminary draft of the Unidroit convention on international interests in mobile equipment and the preliminary draft protocol thereto on matters specific to space property, proposed by the delegation of Italy;

(c) Issues relating to protection of intellectual property rights in connection with outer space activities, proposed by the delegation of South Africa;

(d) Commercial aspects of space activities, proposed by the delegation of Argentina.

101. Some delegations expressed the view that the proposal of the Czech Republic would be appropriate for inclusion in the agenda of the Legal Subcommittee in view of the completion by the Scientific and Technical Subcommittee of its technical report on space debris (A/AC.105/720). In the view of those delegations, that report provided a sufficient basis for the review of existing norms of international law relating to the subject. However, other delegations expressed the view that the technical content of that report was still in the process of being analysed and it would therefore be premature to consider the manner in which possible legal issues relating to the topic might be addressed. The view was also expressed that it was the economic costs rather than the scientific and technical aspects that prevented a decision from being taken on the review of the legal consequences of the issue of space debris.

102. Some delegations expressed the view that, given the new requirements arising from the rapid development in space-related ventures and technologies, as well as the growing role of non-state actors in outer space activities, the inclusion in the agenda of a new single issue/item for discussion on the commercial aspects of space activities, as proposed by Argentina, would be appropriate in order to identify issues of priority in that regard that could be examined further. However, the view was expressed that the scope of the item proposed by Argentina was too broad to allow for an effective, focused discussion leading to any tangible results. The view was also expressed that the scope of the subject should be limited to the legal problems arising from the commercialization of space technology applications.

103. The Subcommittee noted that South Africa had withdrawn its proposal, on the understanding that issues relating to intellectual property rights could be considered within the framework of the proposal made by Argentina.

104. The view was expressed that a single issue/item for discussion on the advisability of developing a single comprehensive United Nations convention on the law of outer space should be included on the agenda of the Legal Subcommittee, as proposed by the Russian Federation, in order to allow for a preliminary consideration of issues relating to that possible task. However, another delegation

expressed doubts about the need for such a convention and, in particular, expressed the view that such an exercise, which would by its nature be extremely complex and involve a large number of States, was not currently warranted.

105. Some delegations expressed the view that, given its low level of ratifications and signatures, the Moon Agreement should be considered under a new agenda item, as proposed by Australia, in order to examine obstacles to its universal accession and acceptance and its effectiveness as part of the international space law regime. Other delegations expressed the view that the scope of amended item 4 of the proposed agenda was sufficiently broad to allow for the inclusion of the discussions envisaged in the proposal of Australia and there was consequently no need for an additional item on the matter.

106. Some delegations expressed the view that consideration within the Legal Subcommittee of the preliminary draft Unidroit convention on international interests in mobile equipment and the preliminary draft protocol thereto on matters specific to space property, as proposed by Italy, would be most valuable and timely. However, the view was expressed that a decision on whether to include it in the agenda for the Subcommittee at its fortieth session would have to be postponed until the forty-third session of the Committee on the Peaceful Uses of Outer Space, to be held in June 2000, in order to allow time for delegations to consider the results of the Third Joint Session of Unidroit, which had recently concluded.

107. The Legal Subcommittee expressed its thanks to Unidroit for reporting on its activities at the thirty-ninth session of the Subcommittee and requested that it continue to keep the Subcommittee informed of developments in that regard.

108. In accordance with the agreement reflected in document A/AC.105/C.2/L.221 (see annex III), the Legal Subcommittee agreed that current agenda item 6, "Matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union", should remain as a regular item on its agenda. However, the Working Group on the item would consider only matters relating to the definition and delimitation of outer space and would not consider the issue of equitable access to the geostationary orbit. That arrangement could be re-examined in due course, in accordance with the normal procedure of the Subcommittee, if further developments warranted.

109. The Legal Subcommittee agreed that current agenda item 7, "Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space", should be retained as a single issue/item for discussion on the agenda of its fortieth session.

110. The Legal Subcommittee agreed that the work plan for current agenda item 8, "Review of the status of the five international legal instruments governing outer space", had been completed at its current session and that the item should therefore not be retained on the agenda of its fortieth session.

111. The Legal Subcommittee agreed that the change to current agenda item 4 (reflected in para. 113 of the present report) was intended to confirm that discussion under the item would include the status of the treaties, review of their implementation and obstacles to their universal acceptance. The view was expressed that discussion under the agenda item should include the advisability of developing a single comprehensive United Nations convention on the law of outer space. Another delegation expressed the view that discussion under this agenda item should include matters relating to the low level of ratification of the Moon Agreement. Some delegations expressed the view that, for the above purposes, a working group might be established by the Subcommittee in accordance with its usual procedure, as appropriate, in order to examine any specific matters under agenda item 4.

112. The Legal Subcommittee conducted informal consultations, coordinated by Niklas Hedman (Sweden), with a view to reaching agreement on proposals to the Committee on the Peaceful Uses of Outer Space for inclusion in the agenda of the fortieth session of the Subcommittee.

113. The Legal Subcommittee agreed on the following items to be proposed to the Committee on the Peaceful Uses of Outer Space for inclusion in the agenda of the fortieth session of the Subcommittee:

(i) Regular items

1. Opening of the session, election of the Chairman and adoption of the agenda.
2. Statement by the Chairman.
3. General exchange of views.
4. Status and application of the five United Nations treaties on outer space.

5. Information on the activities of international organizations relating to space law.

6. Matters relating to:

(a) The definition and delimitation of outer space;

(b) The character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union.

(ii) Single issues/items for discussion

7. Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space.

(iii) Agenda items considered under work plans

8. Review of the concept of the "launching State".

(iv) New items

9. Proposals to the Committee on the Peaceful Uses of Outer Space for new items to be considered by the Legal Subcommittee at its forty-first session.

114. The full text of the statements made by delegations during the discussion on agenda item 10 is contained in unedited verbatim transcripts (COPUOS/Legal/T.629-637).

Notes

[1] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* and corrigendum (A/54/20 and Corr.1), para. 90.

[2] Ibid., para. 114.

[3] *Official Records of the Third United Nations Conference on the Law of the Sea*, vol. XVII (United Nations publication, Sales No. E.84.V.3), document A/CONF.62/122.

[4] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* and corrigendum (A/54/20 and Corr.1), para. 100.

Annex I

Report of the Chairman of the Working Group on agenda item 6, "Matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union"

1. At its 622nd meeting, on 27 March, the Legal Subcommittee re-established its Working Group on agenda item 6, "Matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union". At its 627th meeting, on 29 March, the Subcommittee elected Héctor Raúl Pelaez (Argentina) Chairman of the Working Group.

2. The Working Group on agenda item 6 had before it the report of the Legal Subcommittee on its thirty-eighth session, held in Vienna from 1 to 5 March 1999 (A/AC.105/721), annex I of which contained the report of the Chairman of the Working Group at that session.

3. In addition, the Working Group had the following documents before it for consideration:

(a) Note by the Secretariat entitled "Questionnaire on possible legal issues with regard to aerospace objects: replies from Member States" (A/AC.105/635 and Add.1-5), submitted to the Legal Subcommittee at its thirty-seventh session;

(b) Note by the Secretariat entitled "Comprehensive analysis of the replies to the questionnaire on possible legal issues with regard to aerospace objects" (A/AC.105/C.2/L.204), submitted to the Subcommittee at its thirty-sixth session;

(c) Working paper entitled "Some considerations concerning the utilization of the geostationary satellite orbit" (A/AC.105/C.2/L.200 and Corr.1), submitted by Colombia to the Subcommittee at its thirty-fifth session;

(d) Two documents updated by the Secretariat in cooperation with the International Telecommunication Union (ITU), in response to a recommendation by the Working Group at the thirty-eighth session:

(i) Working paper entitled "An analysis of the compatibility of the approach contained in the working paper entitled 'Some considerations concerning the utilization of the geostationary orbit' with the existing regulatory procedures of the International Telecommunication Union" (A/AC.105/C.2/L.205/Rev.1);

(ii) Conference room paper containing a compendium of documentation relating to the geostationary orbit (A/AC.105/C.2/2000/CRP.3/Rev.1).

4. While noting the work undertaken by ITU relating to the scientific and technical aspects of the utilization of the geostationary orbit, some delegations expressed the view that, as mandated by the General Assembly, the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee were the competent bodies to discuss the legal and political aspects of the geostationary orbit.

5. Some delegations expressed the view that there was a need to establish a legal regime for regulating access to and the use of the geostationary orbit, which was a limited natural resource and had *sui generis* characteristics. Such a regime should guarantee equitable access to the geostationary orbit for all States, taking particular account of the needs of developing countries.

6. Some delegations expressed the view that the legal regime applying to outer space had been established by the General Assembly in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Assembly resolution 2222 (XXI), annex), and thus the status of any satellite orbit, including the geostationary orbit, was fully covered by the provisions of that Treaty. Those delegations were of the view that with regard to

space activities for telecommunication purposes, ITU was the sole competent body responsible for regulating the use of the radio frequencies and related orbits, including the geostationary orbit, that were used by the various radio-communication services, by virtue of the provisions of article 44 of its Constitution, as amended by the Plenipotentiary Conference of ITU, held in Minneapolis, United States of America, in 1998.

7. The representative of ITU made a statement on the coordination procedures of the Union relating to the geostationary orbit.

8. The Working Group noted with appreciation the presentation, by France, with the support of Austria, Belgium, the Czech Republic, Germany, Greece, Hungary, Italy, the Netherlands, Portugal, Romania, Spain and Sweden, of a conference room paper entitled "Some aspects concerning the use of the geostationary orbit" (A/AC.105/C.2/2000/CRP.7). Subsequently the delegation of Colombia joined in sponsoring the paper.

9. On the basis of comments made during the discussion and following informal consultations among delegations, the Working Group amended and adopted conference room paper A/AC.105/C.2/2000/CRP.7.

Annex II

Report of the Chairman of the Working Group on agenda item 9, "Review of the concept of the 'launching State'"

1. At its 622nd meeting, on 27 March 2000, the Legal Subcommittee established a Working Group on agenda item 9, "Review of the concept of the 'launching State'". At its 629th meeting, on 30 March, the Subcommittee elected Kai-Uwe Schrogl (Germany) Chairman of the Working Group.

2. For purposes of information, the Working Group had before it a conference room paper entitled "Presentations on new launch systems and ventures at the thirty-seventh session of the Scientific and Technical Subcommittee, Vienna, 7-18 February 2000" (A/AC.105/C.2/2000/CRP.8).

3. At the first meeting of the Working Group, on 31 March, the Chairman recalled the tasks before the Working Group and the work plan of its deliberations as set out in the report of the Committee on its forty-second session.[a] Referring to the trends towards international launches and towards increased privatization of space transportation since the adoption of the Convention on International Liability for Damage Caused by Space Objects (General Assembly resolution 2777 (XXVI), annex, the "Liability Convention") and the Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex, the "Registration Convention"), the Chairman stated that the Working Group should consider two questions over the course of the three-year work plan. Firstly, it should consider whether the definition of the "launching State" in the Liability Convention and the Registration Convention still covered all existing activities. Secondly, it should consider what steps could be taken to improve application of the concept in the context of new developments in space transportation. The Chairman noted that the end product of the Working Group's deliberations could take a number of forms, but that the Group should not propose to change existing treaties.

4. The Working Group heard a presentation entitled "Launch activities in Japan" made by the delegation of Japan. Launches in Japan were carried out only by two government-related entities, the National Space Development Agency (NASDA), a public corporation established and regulated by the NASDA Law, and the Institute of Space and Astronautical Science, a government research institute. Future launches planned by a private company would be consigned to NASDA, which would carry out the launches. The presentation also stated that NASDA was required under the NASDA Law to purchase third-party liability insurance for each launch. For those reasons, the presentation concluded that the responsibilities of the Government of Japan under the outer space treaties were being fully performed.

5. The Working Group heard a presentation entitled "The notion of launching State in the light of current evolution of space activities" made by the delegation of France. The opinion was expressed that, although the concept of the launching State worked adequately in nearly all cases, problems might occur in a few situations resulting from new launching techniques and increasing commercialization of space activities. In particular, problems might arise from the possibility of launching from international territory, with private parties being able to adopt jurisdictions of convenience, from reusable launch vehicles, from launches from international air space and from the sale of satellites in orbit.

6. The Working Group heard a presentation entitled "New launch systems and ventures" made by the delegation of the United States of America. The presentation included a review of the launch licensing system administered by the Federal Aviation Administration of the United States. It was stated that national measures to implement existing obligations of launching States were central to any discussion in the Legal Subcommittee of new launch ventures and that national launch licensing systems should include a thorough safety review and approval process and should consider establishing levels of foreseeable risk and imposing reasonable insurance requirements or other evidence of financial responsibility. The presentation welcomed the fact that, in the light of the above considerations, the work plan of the Subcommittee concentrated on the application of the concept of the launching State by States and international organizations and upon measures

to increase adherence to the conventions relating to outer space.

7. The Working Group heard a presentation entitled "Eurockot, a new German/Russian commercial launch service provider" made by the delegation of Germany. Eurockot was a joint venture between the Khrunichev State Research and Production Space Center, a Russian state-owned company, and DaimlerChrysler Aerospace, a private German aerospace company. Registration, insurance, launch safety and liability were covered by the Launch Services Agreement, national and international laws and consultations with the Governments of Germany and the Russian Federation to ensure fulfilment of international obligations.

8. The Working Group heard a presentation by the delegation of the Russian Federation. It was stated that existing international space law might not contain comprehensive norms that would adequately govern various private activities in outer space. Since the five treaties relating to outer space were closely interrelated, any changes that might be necessary in view of recent increases in private space activity should be instituted through the development of a single, comprehensive convention on the law of outer space. Meanwhile, possible interpretation of certain concepts in the agreements relating to outer space, including "launching State", "procures the launching" and "from whose territory or facility a space object is launched", could be considered. Although authoritative interpretations could be made only by States parties, the Legal Subcommittee could play a supportive role. It was stated that priority issues to be considered in the Legal Subcommittee under the agenda item included launches from international territory, construction of space objects in outer space and transfer of ownership of a space object after launch.

9. A compilation of the presentations made to the Working Group was distributed in a conference room paper (A/AC.105/C.2/2000/CRP.12).

10. The view was expressed that the review of the concept of the "launching State" should be based not only on the Liability Convention and the Registration Convention, but also on relevant provisions of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (General Assembly resolution 2222 (XXI), annex), and other agreements relating to outer space.

11. The view was expressed that, in addition to the treaties and national legislation relating to outer space, bilateral agreements were also making an important contribution to the development of international law governing responsibility and liability for launch activities.

12. Some delegations expressed the view that the Working Group could not formulate an authoritative interpretation of the concept of the "launching State", as contained in the agreements relating to outer space, since that would be the task of a conference of States parties to the relevant treaties. However, the view was also expressed that the Working Group should attempt to reach a joint understanding on the concept of the launching State. Some other delegations expressed the view that the results of the work of the Legal Subcommittee on the concept of the launching State would have considerable normative value.

13. The view was expressed that the Working Group could develop a draft interpretation of the concept of the launching State, which could be submitted to a conference of States parties to the relevant treaties, if convened.

14. The view was expressed that the Working Group should not focus exclusively on development of national legislation, but should also review other aspects of the concept of the launching State and national liability.

15. The Working Group requested the Secretariat to prepare a compilation of documents relevant to the agenda item, with the assistance, where necessary, of member States and international organizations.

16. The Working Group noted that the delegation of Sweden would present its national space law during consideration of the matter by the Working Group in 2001 under the second year of the work plan and encouraged other delegations to do the same.

17. The Working Group recommended that discussion by the Working Group under the second year of the work plan of the topic "Review of the concept of the 'launching State' as contained in the Liability Convention and the Registration Convention as applied by States and international organizations" should include consideration in greater detail of the observations made during the first year of the work plan and should hear presentations on the practice of space law, including presentations on national space legislation and other relevant texts.

Notes

[a] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* and corrigendum (A/54/20 and Corr.1), para. 114.

Annex III

Some aspects concerning the use of the geostationary orbit

Paper adopted by the Legal Subcommittee

1. In its related resolutions, the General Assembly has regularly endorsed the recommendations of the Committee on the Peaceful Uses of Outer Space that its Legal Subcommittee continue its examination of matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of this orbit, without prejudice to the role of the International Telecommunication Union (ITU).

2. In 1996, Colombia submitted to the Legal Subcommittee at its thirty-fifth session a working paper entitled "Some considerations concerning the utilization of the geostationary orbit" (A/AC.105/C.2/L.200 and Corr.1), recommending certain principles that could be applied to the management of frequencies and orbital positions relating to the geostationary satellite orbit.

3. Following the presentation and ensuing discussion, it did not prove possible for the Legal Subcommittee to endorse the paper. At the thirty-eighth session of the Legal Subcommittee, in 1999, after an impressive presentation made by the representative of Colombia, the outcome of the discussion was that Colombia's standpoint should secure agreement on a text that would address the concerns expressed, without leading to implementation difficulties with ITU.

4. The Legal Subcommittee must find a way to reach an agreement on this important question. With this in mind and taking into account all of the points of view that have been expressed, the Legal Subcommittee adopts the recommendations made in paragraph 8 below.

5. Article 44, paragraph 196.2, of the ITU Constitution as amended by the Plenipotentiary Conference, held in Minneapolis, United States of America, in 1998, states:

> "In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries."

6. Access to frequency bands other than those which are planned is at present governed by the principle of "first come, first served". That approach, while suited to developed countries, may disadvantage developing countries, especially those yet to have access to that orbit. The existing coordination procedures that apply to the non-planned bands are designed to overcome that difficulty, but they are not necessarily capable of giving full satisfaction. There is therefore a need to facilitate access to the orbit/spectrum resource by developing countries or countries yet to have access to that orbit/spectrum resource in relation to those already using it, that is, to ensure equitable access between those countries already having access to the orbit/spectrum resource and those seeking it.

7. In conclusion, the Legal Subcommittee considers that:

(a) In accordance with article 44 of the ITU Constitution, the satellite orbits and radio frequency spectrum are limited natural resources, which must be used rationally, efficiently, economically and equitably;

(b) It is necessary to facilitate equitable access to the orbit/spectrum resource;

(c) ITU has planned the use of certain frequency bands and services for the geostationary orbit;

(d) In many frequency bands and services access to frequencies and satellite orbits, including the geostationary satellite orbit, takes place according to the principle of "first come, first served";

(e) The current regulations on access to frequencies and satellite orbits in respect of bands and services may give rise to situations involving difficult processes of

coordination among developed as well as developing countries.

8. The Legal Subcommittee therefore recommends that:

(a) Where coordination is required between countries with a view to the utilization of satellite orbits, including the geostationary satellite orbit, the countries concerned take into account the fact that access to that orbit must take place, *inter alia*, in an equitable manner and according to the ITU Radio Regulations. Consequently, in the case of comparable requests for access to the spectrum/orbit resource by a country already having access to the orbit/spectrum resource and a developing country or another country seeking it, the country already having such access should take all practicable steps to enable the developing country or other country to have equitable access to the requested orbit/spectrum resource;

(b) Countries wishing to use frequencies and satellite orbits, including the geostationary satellite orbit, in the above-mentioned cases file such requests according to the relevant provisions of the ITU Radio Regulations, taking into account resolution 18 of the ITU Plenipotentiary Conference (Kyoto, 1994) and resolution 49 of the ITU World Radiocommunications Conference (Geneva, 1997) in order to guarantee effective use of the orbit/spectrum resource;

(c) Item 6 of the agenda of the Legal Subcommittee continue to remain on the agenda of the Subcommittee. However, no working group shall be convened on the issue of equitable access to the geostationary orbit. This decision could be re-examined in due course, in accordance with the Subcommittee's normal procedure, if further developments warranted;

(d) This document will be made available to ITU.

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National Aeronautics and Space Administration

Note by the Secretariat

The National Aeronautics and Space Administration of the United States of America has submitted the attached annual publication entitled *Spinoff 1999* for the information of the members of the Committee on the Peaceful Uses of Outer Space.*

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* In view of the limited number of copies received, the publication is being distributed to the members of the Committee only. The publication is available only in the language in which it was submitted (English).

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General Assembly

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Committee on the Peaceful Uses of Outer Space

Note verbale dated 3 July 2000 from the Permanent Mission of South Africa to the United Nations (Vienna) addressed to the Secretary-General

1. The Permanent Mission of South Africa to the United Nations (Vienna) presents its compliments to the Secretary-General of the United Nations and, in accordance with article 5, paragraph 1, of the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Space Objects Launched into Outer Space (General Assembly resolution 2345 (XXII), annex), wishes to notify the Secretary-General that three space objects have been discovered on South African territory. The objects were found in Durbanville, Worcester and Robertson, respectively, in the Western Cape Province of South Africa, on 27 April 2000.

2. The first object is a cylindrical steel vessel 2.7 metres long and 1.5 metres in diameter weighing 260 kilograms. The second object is a spherical metal object 60 centimetres in diameter and weighs approximately 33 kilograms. The third is a tapered, cylindrical and pipe-like object made from non-metallic, probably composite materials. It is approximately 60 centimetres long, 30 centimetres in diameter at "base" and 20 centimetres at "apex" and weighs approximately 30 kilograms. Preliminary investigations, in conjunction with Nicholas L. Johnston, Chief Scientist and Program Manager of the Orbital Debris Program Office at the Johnson Space Center of the National Aeronautics and Space Administration of the United States of America, revealed that the objects were believed to be component parts of a DELTA II second stage rocket used to launch a United States Global Positioning System (GPS) satellite on 28 March 1996. An investigation concluded that the objects posed no risk of hazards to people and property, and were being kept by the South African Astronomical Observatory in Cape Town.

3. In accordance with article 5, paragraph 1, of the 1968 Agreement, the Government of South Africa is also notifying the Government of the United States of America.

V.00-55419 (E) 120700 120700

4. The Permanent Mission of South Africa further has the honour to request that the present communication be circulated to Member States as an official document of the Committee on the Peaceful Uses of Outer Space.

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Committee on the Peaceful Uses of Outer Space

Report on the Tenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators

(Stockholm and Kiruna, Sweden, 2 May-9 June 2000)

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I. Introduction

A. Background and objective

1. The Tenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators, held in Stockholm and Kiruna, Sweden, from 2 May to 9 June 2000, was organized by the United Nations Programme on Space Applications of the Office for Outer Space Affairs of the United Nations Secretariat in cooperation with the Government of Sweden as part of the 2000 activities of the Office for Outer Space Affairs. As was the case for the nine previous courses in the series, the course in 2000 was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Cooperation Agency (SIDA) on behalf of the Government of Sweden and was hosted by the Department of Physical Geography of the University of Stockholm in Stockholm and by Satellus AB (formerly Satellitbild SSC), which is part of the Swedish Space Corporation, in Kiruna.

2. The present report describes the organization of the training course, its technical contents, the results of the course evaluation and the proposed follow-up action. It has been prepared for submission to the Committee on the Peaceful Uses of Outer Space at its forty-fourth session and to its Scientific and Technical Subcommittee at its thirty-eighth session, in 2001. Participants reported on the knowledge acquired and the work conducted during the course to the appropriate authorities of the Government, universities and research institutions in their respective countries.

B. Organization and programme

3. Application forms for and information brochures on the training course were sent out in early December 1999 by the Office for Outer Space Affairs to the permanent missions to the United Nations of 51 developing countries. Copies were also sent to the local offices of the United Nations Development Programme in those countries for transmission to the relevant national authorities. The same materials were also distributed simultaneously to relevant Swedish embassies and to previous course participants for circulation in their academic institutions. One hundred and forty-one completed applications from 36 countries were subsequently received and processed jointly by the Office for Outer Space Affairs and the University of Stockholm.

4. Twenty-six candidates, 9 of them women, were selected as participants from the following 23 countries: Angola, Bangladesh, Brazil, Chile, Costa Rica, Dominican Republic, Ethiopia, Ghana, Guyana, Kenya, Lao People's Democratic Republic, Malawi, Nepal, Nicaragua, Pakistan, Panama, Senegal, Sri Lanka, Uganda, United Republic of Tanzania, Viet Nam, Zambia and Zimbabwe. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. Support for the international travel of the remaining 13 participants, as well as the cost of room and board, course materials and inland transport for all 26 participants, was provided by the Government of Sweden. The European Space Agency (ESA) financed the participation of one course instructor.

5. Course instructors and speakers came from several institutions, including the Office for Outer Space Affairs, ESA, SIDA, the University of Stockholm, the Swedish Royal College of Technology, the University of Uppsala, the Swedish National Space Board, the National Land Survey of Sweden, the Environmental Satellite Data Centre, I. & I. Monitor and Satellus.

II. Summary of the contents of the Course

6. Except for minor modifications to reflect technological advances and feedback received during annual course evaluations, the content and structure of the course have not changed significantly over the years. The course is modular in format and consists of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in the report on the fifth course in the series (A/AC.105/617).

7. The first technical module of the course lasted three days and dealt with the fundamental principles of remote sensing. The principal topics covered were the following: electromagnetic radiation, the reflective properties of various types of materials on the surface of the Earth and elementary optics; electronic imaging; georeferencing of objects in the field, on maps and on satellite imagery; and Earth resources and environmental satellites.

8. Five days were subsequently devoted to image interpretation and presentations on the following subjects: remote sensing for land use planning and environmental monitoring; remote sensing for geological studies; and introduction to visual interpretation and in-service training in developing countries.

9. To reinforce understanding of the principles of image interpretation, participants were divided into groups on a regional basis; each group studied a case where visual interpretation of satellite images played a key role.

10. The next series of lectures dealt with digital image analysis and geographic information systems (GIS). That aspect of the programme lasted six days and covered the following subjects: digital analysis (theory); computer image enhancement (theory); GIS theory; and digital image processing techniques, including computer-aided analysis, GIS applications, CD-ROM data capture, compass techniques and global positioning systems (GPS).

11. The participants were also introduced, over a period of four days, to the principles of radar image formation and the use of such images in various development and research applications. In addition, they were introduced to the use of appropriate procedures for the field verification of interpretations of remotely sensed data using satellite images of the Skinnskatteberg area in southern Sweden.

12. The next part of the course was held in Kiruna, at the facilities of Satellus. Four days were reserved for visual interpretation in project planning exercises and presentation of results. Wherever possible, these exercises were carried out on images selected by the participants of areas of their countries with which they were familiar. Lectures were also presented on the following subjects: archiving, catalogue updating and standard production of images; image processing, value-added production, radiometric and geometric corrections, digital elevation model (DEM) production and ortho image production; computerized cartography; standard and higher-level processed imagery; and future Earth resource satellites.

13. While at Kiruna, participants made technical visits to a number of sites of interest, including the ESA/Salmijärvi and Esrange satellite receiving stations and the Kirunavaara underground mine. Lectures were supplemented by tours of the production facilities of Satellus.

14. The final part of the course concerned the development of remote sensing curricula and was held over a period of three days in Stockholm at the Department of Physical Geography. The participants worked in small groups set up on a regional basis and on the last day of this part of the course each group presented a sample remote sensing curricula project, which, in addition to educational content, included such components as necessary teaching staff and equipment and required budget. The participants also received and took back home sets of teaching materials, which included books, teacher's notes, slides and images.

III. Course evaluation

15. On the last day of the course, during a half-day evaluation session, participants made a formal presentation of the course evaluation to representatives of the Office for Outer Space Affairs, the Department of Physical Geography and several course lecturers. Discussions following the formal presentation made by a representative of the participants allowed additional inputs to be made by all participants.

16. During the discussions, the participants made some suggestions they believed would improve the programme of the course in the future. The main suggestions and recommendations made were as follows: (a) the duration of the course should be extended to up to one academic semester; (b) the digital image processing and GIS parts of the programme should be expanded; and (c) additional training in advanced technologies and microwave remote sensing should be organized on a regular basis as a follow-up to the programme.

17. As a precursor to the larger-scale exercise described in section IV below and in order to evaluate the local impact of the training courses, a questionnaire developed by the Office for Outer Space Affairs was distributed among the participants during the final part of the course. The questionnaire included questions on participation of educators from participants' institutions/universities in the previous United Nations/Sweden training courses from 1990 to 1999 and the impact of any training received on curriculum development and educational programmes in the respective institutions/universities.

18. Twenty-five participants completed the questionnaire, 15 of whom confirmed that at least one person from their respective institution/university had participated in a United Nations/Sweden training programme between 1990 and 1999. In 10 cases it was clearly indicated that training received by past participants of the course had led either to the introduction of new programmes on remote sensing or to the enhancement of existing programmes, or to new research and application projects at the respective academic institution.

19. The results of the Workshop on the Evaluation of the United Nations/Swedish International Development Agency International Training Course Series on Remote Sensing Education for Educators, organized jointly by the United Nations Programme on Space Applications and the Government of Sweden in Gaborone from 18 to 21 October 1998, were also discussed. The workshop had been organized with the primary aim of evaluating the series of training courses, held annually in Sweden since 1990 (except in 1991), and of determining the future direction the courses should take. Thirty-two academic-level teachers from African countries who had previously attended the training courses on remote sensing education for educators between 1990 and 1996 participated in the workshop and their experience in either introducing or enhancing remote sensing education in their own institutions was a major input to the workshop. Information on the programme and recommendations of the workshop as well as proposed follow-up actions can be found in the report of the workshop (A/AC.105/709).

20. In order to evaluate the general organization of the training programme, a questionnaire prepared by SIDA was distributed among participants during the final part of the course. A summary of the opinions of the participants extracted from the 17 questionnaires completed is as follows: (a) 59 per cent thought the course was right in length; (b) 18 per cent found the schedule too heavy; and 59 per cent thought the daily schedule was right; (c) 47 per cent found that the theoretical training corresponded to their professional needs to a large or very large extent; and 41 per cent said the same about the practical training; (d) 94 per cent found the overall level of the programme to be adequate from their personal professional point of view; (e) 82 per cent found that there were subjects not adequately covered in the programme, with most of them indicating digital techniques and GIS as being such subjects; (f) 71 per cent found the methods of instruction to be very good; and (g) 47 per cent thought that they would have an opportunity to apply the newly acquired knowledge and experience in their present employment to a great or very great extent.

21. The feedback received from the exercise will be taken into account in the development of the course programme for 2001, as, for example, recommendations made by participants in 1999 led to the extension of teaching in the practical use of GIS in 2000.

22. At the conclusion of the discussions the participants expressed their appreciation to the Government of Sweden, SIDA, the University of Stockholm and the United Nations for making possible their participation in the training programme.

IV. Proposed follow-up action

23. In order to obtain a better overview of the impact of the series of training courses on curriculum development and educational programmes at the local level, two questionnaires will be developed by the Office for Outer Space Affairs, in consultation with the University of Stockholm, by the end of 2000 and will be sent to all institutions and universities, members of whose staff have attended the courses. The questionnaires are intended to determine the results of the implementation at the local level of the knowledge and techniques acquired during the training programmes. The questionnaires will also examine successes and failures in introducing or enhancing remote sensing education in those institutions and the reasons for them.

24. The first questionnaire will target all former participants who attended any of the courses between 1990 and 2000. The second questionnaire will be sent to heads of departments or institutions/universities where former participants work. The "two-group" approach will provide a good picture of the contributions made by former participants in the development of remote sensing education programmes in their respective academic institutions.

25. Information from completed questionnaires will be processed jointly by the Office for Outer Space Affairs and the University of Stockholm in order to evaluate the local impact of the training courses and to enhance the effectiveness of the programme in the future, as well as to determine types of further training or academic assistance needed by former participants who are actively involved in remote sensing education.

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Committee on the Peaceful Uses of Outer Space

Report on the Ninth United Nations/European Space Agency Workshop on Basic Space Science: Satellites and Networks of Telescopes—Tools for Global Participation in the Study of the Universe

(Toulouse, France, 27-30 June 2000)

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I. Introduction

A. Background and objectives

1. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) and the Vienna Declaration on Space and Human Development recommended that activities of the United Nations Programme on Space Applications promote collaborative participation among Member States at both the regional and international levels, emphasizing the development of knowledge and skills in developing countries.[1]

2. At its forty-second session, in 1999, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposia and conferences planned for 2000.[2] Subsequently, the General Assembly, in its resolution 54/67 of 6 December 1999, endorsed the United Nations Programme on Space Applications for 2000.

3. Pursuant to resolution 54/67 and in accordance with the recommendation of UNISPACE III, the Ninth United Nations/European Space Agency (ESA) Workshop on Basic Space Science: Satellites and Networks of Telescopes—Tools for Global Participation in the Study of the Universe was organized by the United Nations, ESA and the Government of France at the Centre national d'études spatiales (CNES), in Toulouse, France, from 27 to 30 June 2000. The workshop was co-organized by the Austrian Space Agency, CNES, the Committee on Space Research, ESA, the German Space Agency, the International Astronomical Union, the National Aeronautics and Space Administration (NASA) of the United States of America and the United Nations. CNES acted as host of the workshop on behalf of the Government of France.

4. The workshop continued the series of United Nations/ESA workshops on basic space science organized for the benefit of developing countries in India in 1991 and Sri Lanka in 1996 for Asia and the Pacific (see A/AC.105/489 and A/AC.105/640); in Colombia and Costa Rica in 1992 and Honduras in 1997 for Latin America and the Caribbean (see A/AC.105/530 and A/AC.105/682); in Nigeria in 1993 for Africa (see A/AC.105/560/Add.1); in Egypt in 1994 and Jordan in 1999 for western Asia (see A/AC.105/580 and A/AC.105/723); and in Germany in 1996 for Europe (see A/AC.105/657).

5. The main objective of the workshop was to provide a forum to highlight recent scientific results obtained using major space-based observatories in studies of the stars and the far reaches of the universe. Such satellite missions constitute an impressive means of studying all aspects of basic space science from space as a complement to studies being done from the ground. The question of the large volumes of data generated by such missions was discussed in relation to changing research needs within the scientific community, as was how access to the important databases maintained by major space agencies could be facilitated. The importance of data research and education based on space missions was discussed, together with the relevance of such missions to the needs of developing countries wishing to participate actively in the voyage of discovery through the universe. Future access to space by means, for example, of a world space observatory was seen as crucial. Anticipated long-term developments will necessitate early planning and an examination of the capabilities associated with the running of such an observatory.

6. The present report was prepared for submission to the Committee on the Peaceful Uses of Outer Space at its forty-fourth session and to its Scientific and Technical Subcommittee at its thirty-eighth session.

B. Programme

7. At the opening of the workshop, introductory statements were made by representatives of CNES, ESA and the United Nations. The workshop was divided into scientific sessions, each focusing on a specific issue. Presentations by invited speakers describing the status of their findings in research and education were followed by brief discussions. Sixty papers were presented by invited speakers from both developing and industrialized countries.

8. The workshop sessions focused on (a) archives of space missions and new observations from space and how to access them; (b) astrophysical data systems and how to utilize them; (c) in situ and remote exploration of the solar system; (d) experience with, results from and the need for networks of optical astronomical telescopes; and (e) the benefits of space science to society. Poster sessions provided an opportunity to focus on specific problems and projects in basic space science. Preceding the workshop, a World Space Observatory/Ultraviolet (WSO/UV) Interest Meeting was held at the venue of the workshop on 26 June 2000.

C. Attendance

9. Researchers and educators from developing and industrialized countries in all economic regions, but in particular from western Asia and Africa, were invited by the United Nations and ESA to participate in the workshop. Participants held positions at universities, research institutions, observatories, national space agencies and international organizations and in private industry, and were involved in all the aspects of basic space science covered by the workshop. Participants were selected on the basis of their scientific background and their experience with programmes and projects in which basic space science played a leading role.

10. Funds provided by the United Nations, ESA and CNES were used to cover travel and other costs of participants from developing countries. Some 80 specialists in basic space science attended the workshop.

11. The following 34 Member States were represented at the workshop: Algeria, Austria, Denmark, Ethiopia, France, Germany, India, Israel, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mauritius, Pakistan, Paraguay, Peru, Poland, Romania, Russian Federation, Saudi Arabia, South Africa, Spain, Sudan, Syrian Arab Republic, Tajikistan, Togo, Tunisia, Uganda, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Viet Nam and Yemen.

II. Observations and recommendations

12. Considering the current maturity of communications technology and the associated rapid evolution of possible benefits through improvements in available services, it is important to maintain the forward movement over the past 10 years in basic space science in the developing countries by expanding the communications capabilities to ensure that the service benefits supplied to the world by the major space agencies are not missed.

13. Technological advances in telescope and instrument design over the last 10 years, coupled with the exponential increase in computer and communications capability, have caused a dramatic change in the character of astronomical research. Large-scale surveys of the sky from space and ground are being initiated at wavelengths from radio to x-ray, thereby generating for the first time a panchromatic view of the universe. With these new capabilities at hand it now becomes feasible to initiate studies of the "virtual observatory" concept for mining astronomical data. Using this concept, the astronomical researcher will not only have access to the terabyte and pentabyte data sets, but will also be able to employ a full range of tools to exploit those data. The creation of a virtual observatory will require new collaboration between the astronomical and computer science communities. It will also provide an opportunity for further collaboration with other disciplines facing similar challenges and will be a venue for educational outreach. The virtual observatory must be globally oriented—as regards both access to archives and the interface to the researcher.

14. A stronger emphasis on international and regional cooperation needs to be developed to implement the network concepts associated with the telescopes distributed in the developing countries. Unless such cooperation efforts in strengthening basic space

science are further exploited, differences in regional development levels will be extremely difficult to overcome and could create sustainability problems in the development process of many developing countries.

15. The participants noted with satisfaction that the stimulus supplied by this series of workshops to the development of basic space science had been recognized by UNISPACE III in its support for the role of basic space science in laying a solid foundation for continued sustainable and accelerated development.

16. The participants also noted the progress made in increasing the active participation of developing countries in front-line space sciences, as had been emphasized in the assessment evaluation of the world space observatory concept carried out for WSO/UV.

17. The participants agreed that WSO/UV presented an opportunity for a major step forward, which could create a new and sustainable stimulus for basic space science on a worldwide scale, as well as open up new and unique opportunities to implement worldwide collaboration. Those opportunities could extend beyond the level of industrialization of participating countries in ways unique in the contemporary world.

18. The participants recommended that efforts be made to take advantage of the new opportunity to create possibilities for intellectual development in parallel with the progress made in sustainable development.

19. The setting up of amateur astronomical societies in countries where they did not already exist was of greatest importance and should be brought to the attention of those bodies which could facilitate it.

20. The participants appreciated the decisions taken by the International Telecommunication Union (ITU) at the World Radio Conference, held in Istanbul in 2000, concerning the extension of frequency bands for the benefit of the international astronomical community.[3]

21. Because of bandwidth limitations, the possibility for widely distributed availability of quality educational material in basic space science and its regular review with regard to relevance has been severely restricted.

22. The participants considered that the project to unify astronomical databases and to make combined information available to astronomical researchers and educators worldwide would create a very valuable resource for the international community.

23. The international astronomical community should be encouraged to consider the inclusion of information from photographic plate archives in future virtual observatory programmes by scanning and calibrating photographic information. This would expand the time period available to users of such a facility since information existed from more than 100 years ago.

24. The participants recognized the importance of the activities developed by the Working Group on Space Sciences in Africa since 1996 (see A/AC.105/657, para. 19), considered that those activities should be expanded and strongly recommended continued support for its work.

25. The participants were pleased to note the progress made in the implementation of the Network of Oriental Robotic Telescopes (NORT) project.

26. The participants noted with satisfaction the number of national observatory projects, which indicated a rising interest in western Asia. Their incorporation into the NORT project in the future was highly desirable, as it would reinforce education and research in astronomy in the region and would stimulate astronomical activities throughout all levels of society.

27. The participants recognized the activities of the Arab Union for Astronomy and Space Sciences (AUASS), which were bringing together individual and group interests throughout the region of western Asia.

III. Summary of presentations

A. Space astronomy, current missions and trends in the next millennium

28. Space astronomy allows access to wavelength regions that are not available to ground-based observatories. Collecting and analysing radiation emitted by phenomena throughout the entire electromagnetic spectrum, NASA's four "Great Observatories" will perform astronomical studies over many different wavelengths and overlapping in time, making possible concurrent observations. The Chandra X-Ray Observatory, deployed in July 1999, will observe x-ray

images and spectra of violent, high-temperature events and objects to help understand black holes, quasars and high-temperature gases. The Space Infrared Telescope Facility (SIRTF) to be launched in December 2001, is capable of observing in the near infrared, 3-180 micron wavelength range and will provide for imaging, photometry and spectroscopy. The primary science themes of the telescope are the detection and study of brown dwarfs and super-planets, proto-planetary and planetary debris disks, ultra-luminous galaxies and active galactic nuclei and deep surveys of the early universe. The detector arrays offer orders of magnitude improvements in capability over past infrared detectors.

29. Astronomical missions scheduled for 2005 and beyond are made possible by advanced technology development. The Space Interferometry Mission (SIM) will use optical interferometry technology, while the Next Generation Space Telescope (NGST) will require large, ultra-light and deformable mirrors and very sensitive instruments. SIM will determine the positions and distances of stars several hundred times more accurately than any previous programme, which will allow the mission to probe nearby stars for Earth-sized planets. SIM will also pioneer a technique to block out the light of bright stars to take images of areas close in to the stars. NGST, to be launched in 2007, will study how galaxies evolve, how stars and planetary systems form and evolve and what the life cycle of matter is in the universe. SIRTF, SIM and NGST are part of NASA's Origins programme and the Chandra Observatory is part of NASA's Structure and Evolution of the Universe programme.

B. Advanced projects design team

30. The NASA Jet Propulsion Laboratory (JPL) pioneered the concept of concurrent engineering by creating the Advanced Projects Design Team (Team X) in April 1995.

31. The objectives of Team X are:

(a) To improve the speed and quality of JPL mission concepts and to create a continuing study process with dedicated facilities, equipment, procedures and tools to produce the best possible proposals;

(b) To develop an initial mission requirements database that can be continually updated and tapped for future project phases;

(c) To develop experienced engineers into mission generalists.

32. Team X enables mission principal investigators and their design teams to plan new mission proposals efficiently.

33. Team X consists of 15 mission design individuals, plus a team leader and a documentarian. Each assigned engineer is responsible for presenting his discipline's expertise and interests. The team leader coordinates and leads the study and is the customer's primary contact before, during and after study sessions. The documentarian establishes electronic files, records significant technical discussions and ensures that study results are properly documented.

34. Team X products are mission design feasibility studies and reviews. A study lasts one to two weeks and results in a 30-80-page report that includes equipment lists, mass and power budgets, system and subsystem descriptions and a projected mission cost estimate. A review is a one- or two-day discussion of a proposal a request for information, a request for proposal, or similar activity. Each team member summarizes his or her view during the final hour and an abbreviated report is the product.

35. During the workshop, a 2½-hour live video conference was conducted with Team X in Pasadena on the development of a satellite mission to planet Mars.

C. Exploration of the Sun

36. In the investigation of the Sun, instruments aboard spacecraft play an important role as they allow the observation of electromagnetic radiation that cannot be received by ground observatories owing to the blocking effect of the Earth's atmosphere. The particle emissions of the Sun, in particular the solar wind, can only be observed from spacecraft that are outside the magnetosphere. In the early 1970s most of the general characteristics of the solar atmosphere above the photosphere and of the solar wind were established by a number of exploratory spacecraft. (NASA's Orbiting Solar Observatory (OSO) satellites and the Skylab Apollo telescopes, together with

plasma- and particle-detection spacecraft from space agencies, were determinant in the knowledge of the solar corona and its relation with the solar wind.)

37. Since that time, space missions have been designed to investigate the physics of the phenomena that had been observed in the exploratory period. The Solar Maximum Mission (SMM) in the 1970s and 1980s specialized in the study of solar flares and led to the discovery of the total solar irradiance variation.

38. Since 1991, the Yohkoh satellite has been studying the very hot solar atmosphere by producing solar images in x-ray and gamma-ray spectra. A complete solar cycle has already been observed and imaged by Yohkoh.

39. Since 1996, the joint ESA/NASA Solar and Heliospheric Observatory (SOHO) mission has been carrying out the most comprehensive space investigation of the Sun by means of a coordinated set of instruments that study the interior solar structure and solar dynamics by helioseismology (solar oscillations), the solar irradiance, the physical phenomena in the solar atmosphere that heat the corona and give rise to the solar wind (extreme UV (EUV) images and spectra), the composition of the hot solar atmosphere and of the solar wind (mass and charge spectroscopy) and the extension of the solar wind to form the heliosphere (H Lyman-alpha mapping of the sky). Since 1998, the Transition Region and Coronal Explorer (TRACE) has complemented the SOHO observations of the solar EUV atmosphere by producing very high resolution images at selected wavelengths.

D. Planet Mars

40. NASA's Mars Global Surveyor (MGS) spacecraft was launched in November 1996 and reached Mars in September 1997. The spacecraft then spent the next 18 months in alternating periods of aerobraking and science data collection as the orbit was modified to the desired near-polar, approximately circular, two-hour period required for mapping. The average altitude above the Martian surface is currently some 400 kilometres. MGS began systematic mapping of the planet in March 1999, using a variety of scientific instruments that include a magnetometer/electron reflectometer (MAG), thermal emission spectrometer (TES), Mars orbiter laser altimeter (MOLA) and Mars orbiter camera (MOC). After one year of mapping, those instruments continue to reveal a number of fundamental surprises about the evolution of Mars as a planet.

41. For example, the MAG instrument has identified regions characterized by contrasting polarity bands whose intensity locally exceeds 1,500 nanotesla. In the Sirenum region, those linear anomalies extend for up to 2,000 kilometres in length and confirm that Mars' internal dynamo shut off very early in the planet's history. TES measures energy emitted from Mars in the middle portion of the thermal infrared part of the electromagnetic spectrum. TES has collected more than 44 million spectra of Mars with a spatial resolution of up to 3 kilometres. Interpretation of those spectra demonstrates that there are isolated occurrences of coarse-grained hematite that may have formed in standing bodies of water. In addition, TES indicates fundamental differences between the volcanic compositions within the northern plains (andesitic) and the southern highlands (basaltic) that provide additional clues regarding the evolution of the planet.

42. The MOLA instrument obtained more than 330 million measurements of the Martian topography during the first year of mapping. The results reveal a regional slope towards the northern lowlands, the tallest volcano in the solar system at 26 kilometres in height (Olympus Mons) and one of the largest known impact basins at 2,100 kilometres across and 9 kilometres deep (Hellas). Such topography data play an important role in gravity studies, which confirm the presence of a thinner, stronger surface layer in the north whose southern extent is not well correlated with the global topographic dichotomy. Moreover, the gravity signature associated with the Tharsis region does not include Olympus Mons, thereby confirming the relative youth of the volcano. Finally, signatures associated with the Chryse region indicate that buried portions of the large outflow channels extend well out into the northern plains. MOC has imaged many local portions of the Martian surface at a resolution of as high as 2-3 metres per pixel. To date, more than 20,000 such images have been released to the public and indicate a startling array of landforms ranging from bizarre polar landscapes to widespread wind-sculpted terrains to heavily modified, ancient water-carved valleys that were formed over an extended period of time.

43. The current MGS mapping mission is scheduled to continue until February 2001 and should ultimately provide data leading to a better understanding of how Mars has evolved over time. Spacecraft operations throughout the mission have been conducted by JPL.

E. Virtual observatory concept

44. Technological advances in telescope and instrument design over the last 10 years, coupled with the exponential increase in computer and communications capability, have caused a dramatic change in the character of astronomical research. Large-scale surveys of the sky from space and ground are being initiated at wavelengths from radio to x-ray, thereby generating for the first time a panchromatic view of the universe. With these new capabilities at hand it now becomes feasible to initiate studies of the "virtual observatory" concept for mining the vast astronomical archives and creating a new engine of discovery for astronomy.

45. Using this concept, the astronomical researcher will not only have access to the terabyte and pentabyte data sets, but will also be able to employ a full range of tools to exploit those data.

46. The creation of a virtual observatory will require new collaboration between the astronomical and computer science communities. It will also provide an opportunity for further collaboration with other disciplines facing similar challenges and will be a venue for educational outreach. The virtual observatory must be globally oriented—as regards both access to archives and the interface to the researcher.

F. Archives of space missions

47. The Strasbourg Astronomical Data Centre (CDS) is dedicated to the collection and worldwide distribution of astronomical data and related information. It is located at the Strasbourg Astronomical Observatory in France.

48. CDS hosts the Set of Identifications, Measurements and Bibliography for Astronomical Data (SIMBAD) astronomical database, the world reference database for the identification of astronomical objects.

49. The goals of CDS are:

(a) To collect all useful information concerning astronomical objects that is available in computerized form: observational data produced by observatories around the world, on the ground or in space;

(b) To upgrade those data by critical evaluation and comparison;

(c) To distribute the results to the astronomical community;

(d) To conduct research based on the data.

50. CDS has signed international exchange agreements with the NASA Astrophysics Data Center; the National Astronomical Observatory of Japan in Tokyo; the Russian Academy of Sciences; the Starlink network of the Particle Physics and Astronomy Research Council of the United Kingdom; the Beijing Observatory; the University of Porto Allegre, Brazil; the University of La Plata, Argentina; and the InterUniversity Centre for Astronomy and Astrophysics of India.

51. CDS plays, or has played, a part in most of the major astronomical space missions: generating guide star catalogues (the European X-Ray Observatory Satellite (EXOSAT), the Infrared Astronomical Satellite (IRAS), Hipparcos, the Hubble Space Telescope, the Infrared Space Observatory (ISO) and the X-Ray Astronomy Satellite (SAX)), helping to identify observed sources (Hipparcos, Tycho and the Roentgen Satellite (ROSAT)) or to organize access to the archives (International Ultraviolet Explorer (IUE)) and so on. CDS contributes to the X-Ray Multi-Mirror (XMM) mission Survey Science Centre, with the High-Energy Team at the Strasbourg Astronomical Observatory.

G. Astrophysical data system

52. The NASA Astrophysics Data System (ADS) provides access to abstracts and scanned articles of the astronomical literature. Funded by NASA, the project provides free access to those abstracts and articles to anybody with Internet access worldwide. There are three databases in ADS: (a) the physics database, containing almost 900,000 references; (b) the astronomy database, with almost 550,000 references; and (c) the instrumentation database, which has almost

600,000 references. The abstracts can be searched through a sophisticated search system.

53. The scanned articles in the ADS article service are increasing in number continuously. ADS has almost 1 million pages scanned so far. All major and most smaller astronomical journals have been scanned back to volume 1. The *Monthly Notices of the Royal Astronomical Society* are currently being scanned back to volume 1. This is the last major journal to be completely scanned and on-line. In cooperation with a conservation project of the Harvard libraries, ADS is currently scanning microfilms of historical observatory literature. This will provide access to an important part of the historical literature.

H. Networks of optical astronomical telescopes

54. The development towards larger and larger telescopes has lead to discussions about the future of many smaller telescopes. Not all science can be done with a few nights on a giant telescope. At the same time, the advances in automation and communications open up opportunities for more efficient and time-saving observing schemes, which means that very large data sets can be obtained and handled. Yet a much larger community can participate and do real scientific work. Amateurs and students become part of the scientific community and can contribute in a significant way in certain areas of astrophysics. This development is particularly important for modern studies of variable stars and the monitoring of the sky for near-Earth objects and other special events.

55. Under the umbrella of AUASS, the NORT proposes, as a first step, to implement university courses in astrophysics and space sciences by telescope training in national observatories with 60 cm-1 metre diameter class telescopes. As a second step, the project proposes a network of 2 metre class robotic telescopes to monitor mainly variable stars and near-Earth objects in photometry, spectrography and polarimetry.

56. The NORT project will be open for cooperation with similar telescope facilities in other regions. At the workshop, projects for and results from optical astronomical telescope facilities have been presented by the following countries: Algeria, Ethiopia, India, Jordan, Lebanon, Malaysia, Mauritius, Pakistan, Paraguay, Peru, Saudi Arabia, South Africa, the Syrian Arab Republic, Togo and Tunisia.

I. Hands-on astrophysics

57. The hands-on astrophysics material uses the unique variable star database of the American Association of Variable Star Observers (AAVSO). It is a curriculum suitable for college and university science, mathematics, and computer science classes and directly involves students and teachers in the scientific process.

58. Hands-on astrophysics helps students acquire fundamental science skills and develop an understanding of basic astronomy concepts; it provides interdisciplinary connections and takes students through the whole scientific process while working with real data. The curriculum also informs students about variable stars and their importance to the professional astronomical community and gives them the necessary information and skills to study variable star behaviour or to become amateur variable star observers.

59. Students learn the necessary skills to make observations, analyse their data with graphing and statistical techniques, make predictions and compare predicted and observational values, as well as how to develop sophisticated mathematical models. Students will learn about variable stars by using the activities, software, charts, slide sets and videos that accompany the teacher and student manual. Students will be able to access the AAVSO database and share their investigations and observations with other students via an Internet site specially developed for the project.

60. The study of variable stars is particularly suited to science, mathematics and computer education. Students can observe variable stars and analyse the brightness changes in the stars they observe by using the database of 600,000 observations and the computer programs provided. The amount of data and the mathematical refinement techniques will give reasonably accurate results. Students will understand that their observations can be reliable and that their data can be useful enough to be used by professional astronomers.

61. In 1999, the hands-on astrophysics material was provided by AAVSO to a number of telescope facilities inaugurated or supported by United Nations/ESA

workshops on basic space science for use with the telescopes and in the teaching curricula (Honduras, Jordan, Morocco, Paraguay, Philippines and Sri Lanka).

J. Astrophysics for university physics courses: a teaching module developed for the United Nations/European Space Agency workshops on basic space science

62. A teaching module was developed for the United Nations/ESA workshops on basic space science presenting an array of astrophysical problems, any one or a few of which can be selected and used within existing physics courses on elementary mechanics or on heat and radiation, kinetic theory, electrical currents and in some more advanced courses. The module presents an answer to the problem of how to introduce astrophysics in physics courses at the university level, in particular in developing countries.

63. Such astrophysics problems are designed to be an interesting and challenging extension of existing physics courses, to determine the student's understanding of physics by testing it in new realms and to stretch the student's imagination. A brief tutorial on astrophysics is provided with each problem so that the physics teacher can present the problem in class. The higher-level problems start with a brief introduction to the physics involved.

64. The teaching module is structured into the following key sections: orbits and Kepler's third law; the solar system; neutron stars and clusters of galaxies; thermal radiation; the lives of stars; cosmic magnetic fields; and high-energy astrophysics.

65. All the problems require compact algebraic and numerical solutions that can easily be translated into physics. For many problems, the solution is shorter than the statement of the problem.

66. Astrophysics is an attractive science not only because it stretches the imagination but also because it is highly interdisciplinary. Astrophysics involves atomic physics, nuclear physics, fluid and plasma physics, solid state physics, chaos theory, organic chemistry, special and general relativity and more. Students are trained in solving specific problems, however, and they acquire a broad view of science largely through solving many kinds of specific problems. Thus, the problems in this teaching module provide a focus for students to which the broader astrophysical challenges can be linked. Most of the text provided with each problem is designed to highlight the broader questions and challenges, which are then crystallized in the given specific problems that are to be solved by the students.

Astrophysics as a frontier science

67. Even students can formulate good questions suitable for research. Some observations made by the Hubble Space Telescope have been requested and will be investigated by high-school students. The frontier nature of astrophysics makes teaching it difficult, however. Even the professional astrophysicist soon learns to admit to some students' questions that he or she does not know and preferably also to suggest that they study the problem together. Indeed, the problems in the teaching module will be difficult to teach because students will inevitably ask questions that go well beyond the specific problem and the tutorial astrophysics provided. Nevertheless, the value of students' formulating questions far exceeds the discomfort of the teacher admitting that he or she does not know. Many physics students merely memorize their physics. The astrophysics breaks them out of memorization and gets them to think independently. Students' questions are a sign of their progress.

Didactics

68. In approaching the theoretical examination of a newly observed phenomenon one should not start with a computer but by determining which kinds of physics are relevant. It is essential to select a few physical parameters and construct a minimum of analytical equations that contain the essential physics. These are often called "back-of-the-envelope" calculations. In astrophysics, one first considers appropriate forms of energy without worrying at the outset about the detailed forces that lead to those energies. One needs to ascertain whether gravitational, nuclear, kinetic or electromagnetic energies or some exchange between two of them are in play and what the main parameters are, such as size or mass of an object, that influence these energies. Sometimes answers can be found by dimensional analysis. It matters little if the numerical coefficients in such estimates may be off by a factor of

two or three. Several of the problems in the teaching module emphasize order of magnitude of analysis and dimensional analysis. In particular, some problems ask students to solve differential equations by a one-step integration, which explicitly brings out the main physical parameters.

Group collaborative learning

69. Frontier science is a collaborative venture. Discussion is an integral part of learning and research in astrophysics. If necessary, the problems in the teaching module can be presented and solved as part of a lecture, but they are selected and written so that they can be discussed and solved by small groups of students, preferably during a class period. Groups of two, three or four students work well, depending in part on the physical limits of the seating arrangement.

70. Students working in groups take much time. The teacher can lecture about three problems in the time that student groups need to do one. Compared with pure lecture courses, some topics of the course must be omitted because the time is no longer available. Nevertheless, assuredly the students will understand the one problem they solved and the teacher will have evidence of it. This is much more useful to the student, in the long run, than some additional material stored incompletely in his or her memory.

71. The teaching module is currently under review at telescope facilities inaugurated or supported by and hosts of United Nations/ESA workshops on basic space science (Colombia, Costa Rica, Egypt, France, Germany, Honduras, India, Jordan, Mauritius, Nigeria, Paraguay, Philippines and Sri Lanka).

IV. World space observatory

72. The United Nations, through its Office for Outer Space Affairs, and ESA have jointly organized a series of workshops on basic space science since 1991 (see para. 3). The implementation of the recommendations of those workshops has strengthened the scientific infrastructure in developing countries. One of the proposals from the workshop participants is the concept of a world space observatory, a satellite mission focusing on the ultraviolet part of the electromagnetic spectrum, with international participation, including that of developing countries.[4]

73. The results of a study to evaluate a World Space Observatory (WSO/UV) reference mission (CDF-05(A)), carried out under the ESA General Studies Programme (Long-Term Planning) were presented to the workshop participants and showed the feasibility of a WSO/UV on a time scale of some six years. The possibility of a joint interest mission involving both the developing countries and the more advanced countries is clearly a more productive approach than a mission that would be of interest only to the developing countries. Such a mission with a broader scope would actually generate a mutually beneficial synergy in the worldwide community of basic space scientists and would thus be a far more effective stimulus for its sustainability. The WSO/UV project model incorporates a 1.7-metre telescope, spectrographs and imagers, orbiting in the Lagrange Point L.2. The study determined that a real opportunity existed at the present time, with a possible launch in 2006. To utilize that opportunity, further avenues to organize broad and early participation need to be explored with urgency and a further study needs to be made of implementation details and associated funding sources. Future workshops could make an important contribution to further exploration of the practical aspects associated with the implementation of the broad multinational participation, in particular for developing countries, both in the project development phase and the operational phases of such a WSO/UV concept mission.

Notes

[1] See *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1, para. 1 (e) (ii), and chap. II, para. 409 (d) (i).

[2] *Official Records of the General Assembly, Fifty-fourth Session, Supplement No. 20* and corrigendum (A/54/20 and Corr.1), para. 52.

[3] See J. Andersen, "Astronomy and the degrading environment", *Science*, vol. 288, 21 April 2000, pp. 443 and 444.

[4] See *Report of the Third United Nations Conference*, op. cit., chap. II, para. 207).

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